

## APPENDIX A

### GLOSSARY

Appendix A includes definitions of terms used in MCTL documents. When a definition from another document is identified, that source is given in parentheses at the end of the definition, according to the following:

CWC	Chemical Weapons Convention
DoD	Department of Defense
EAR	Export Administration Regulations
ISO	International Standards Organization
ITAR	International Traffic in Arms Regulations
JP	Joint Publication
NATO	North Atlantic Treaty Organization
WA	Wassenaar Arrangement

**accessories and attachments.** Associated equipment for any component, end item, or system which are not necessary for their operation, but which enhances their usefulness or effectiveness. (Examples: military riflescopes, special paints, etc.) (ITAR, Sec. 121.8.)

**accuracy.** (*Usually measured in terms of inaccuracy.*) Maximum deviation, positive or negative, of an indicated value from an accepted standard of true value. (WA)

**active.** Guidance by which a missile, warhead, or projectile emits radiation (electromagnetic) and homes in on the signal reflected from a selected target.

**active flight control systems.** Function to prevent undesirable “aircraft” and missile motions or structural loads by autonomously processing outputs from multiple sensors and then providing necessary preventive commands to effect automatic control. (WA)

**active optics.** Optical elements such as mirror surfaces whose shape is actively and continuously deformed by various electromechanical means for the purpose of correcting or controlling the performance of an optical system. The most familiar example is the “rubber mirror” whose surface shape and thus reflective qualities can be controlled by electromechanical means.

**active pixel.** A minimum (single) element of the solid-state array which has a photoelectric transfer function when exposed to light (electromagnetic) radiation. (WA)

**active terminal guidance (or homing).** A method of guidance in which energy is transmitted from the round and guidance information is derived from reflected or scattering of that energy by a target. Varieties of active guidance current in military use or development include radar, ladar, and active acoustics for undersea weapons. See also **semiaactive guidance**.

**active tooling unit.** A device for applying motive power, process energy, or sensing to the workpiece.

**adaptive control.** A control system that adjusts the response from conditions detected during the operation. (Reference: ISO, 2806-1980.)

**adaptive optics.** Optical components or assemblies whose performance is monitored and controlled so as to compensate for aberrations, static, or dynamic perturbations such as thermal, mechanical, and acoustical disturbances, or to adapt to changing conditions, needs, or missions. See also **active optics**.

**additives.** Substances used in explosive formulations to improve their properties. (WA)

**aerostatic.** Bearings in which the moving part is supported by air pressure.

**AG agents.** Australia Group agents.

**aircraft.** A fixed-wing, swivel-wing, rotary-wing (helicopter), tilt-rotor, or tilt-wing airborne vehicle. (WA) See also **civil aircraft**.

**alkylation.** A reaction that introduces an alkyl group. For CWC purposes, a phosphorus-carbon bond is produced.

**alloyed aluminide coatings.** Coatings of nickel or titanium aluminides modified with other metals such as chromium.

**aluminum alloy.** A substance having metallic properties in the form of a mixture composed primarily of aluminum in combination with one or more other chemical elements.

**AMPA-kines.** An AMPA (alpha amino 3 hydroxy 5 methyl isoxazole 4 propionic acid) receptor is one of a group of glutamate receptors in the nervous system. It functions to permit entry of calcium into cells when the cells are stimulated by the neurotransmitter glutamate. Overstimulation of these receptors may lead to pathological consequences. An AMPA-kine stimulates the AMPA system.

**amphibious vehicle.** An automotive vehicle or chassis which embodies all-wheel drive, is equipped to meet special military requirements, and which has sealed electrical systems or adaptation features for deep-water fording. (ITAR, Sec. 121.4.)

**angular position deviation.** The maximum difference between angular position and the actual, very accurately measured angular position after the workpiece mount of the table has been turned out of its initial position. (Reference: VDI/VDE 2617, Draft: "Rotary tables on coordinate measuring machines.")

**antibodies.** Immunoglobulin proteins, made by humans or animals, that bind target molecules with high specificity and affinity. See also **anti-idiotypic antibodies**, **monoclonal antibodies**, and/or **polyclonal antibodies**, and **vaccines**.

**anti-idiotypic antibodies.** Antibodies which bind to the specific antigen binding sites of other antibodies.

**apoptosis.** The process of programmed cell death characterized by reduction in the size of the cell and its nucleus.

**application specific integrated circuit (ASIC).** Preprogrammed VLSI (very large scale integrated) or LSI (large scale integrated) circuit used for a specific application.

**areal density.** Weight per unit area, typically given in lbs/ft<sup>2</sup> or kg/m<sup>2</sup>.

**armor.** Any physical protective covering used on vehicles or persons to defeat projectiles or fragments.

**armor piercing.** Ammunition, bombs, bullets, projectiles, or the like which are designed to penetrate armor and other resistant targets.

**artillery ammunition.** Ammunition for cannon above 30 mm (1.181 in.) in caliber.

**asynchronous transfer mode (ATM).** A transfer mode in which the information is organized into cells; it is asynchronous in the sense that the recurrence of cells depends on the required or instantaneous bit rate. (CCITT Recommendation L.113.) (WA)

**atomic force microscopy (AFM).** An analytical technique that uses a mechanical vibratory probe to examine surface features of biological and chemical materials. The technique achieves a resolution at the atomic level by magnifying topographic surfaces 100 million times. This technique is used in near-field scanning optical microscopy (NSOM).

**Australia Group.** An informal international forum, chaired by Australia, that seeks to discourage and impede the proliferation of chemical and biological weapons by harmonizing national export controls on chemical materials, biological organisms, and dual-use equipment that could be used in production of chemical and biological weapons.

**autoloading.** A capability for automated handling and loading of projectiles (in full autoloading, both projectiles and propellants) from ready stores to firing state without human intervention of any kind.

**automatic target recognition (ATR).** A processing technique wherein data from one or more sensors are automatically manipulated and analyzed to discriminate targets from nontargets without the assistance of a human operator. (WA)

**automatic target tracking.** A processing technique that automatically determines and provides as output an extrapolated value of the most probable position of the target in real time.

**axonal guidance.** During the development of the nervous system, neuronal axons travel to very specific addressable targets. An axon may traverse a distance of centimeters and target a site as small as 100  $\mu$ m. Chemical repellants and attractants allow such targeting.

**ballistic missile.** Any missile which does not rely upon aerodynamic surfaces to produce lift and consequently follows a ballistic trajectory when thrust is terminated.

**ballistics.** The science or art that deals with the motion, behavior, appearance, or modification of missiles or other vehicles acted upon by propellants, wind, gravity, temperature, or any other modifying substance, condition, or force.

**bar.** A unit of pressure that is equal to 10<sup>6</sup> dynes/cm<sup>2</sup>, or 14.5 psi (i.e., approximately sea-level atmospheric pressure).

**basic scientific research.** Experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena or observable facts, not primarily directed towards a specific practical aim or objective. (WA)

**beam-rider guidance.** Radar guidance system in which the vehicle being guided continuously senses, and corrects for, deviation from center of coded radar or laser beam which is usually locked onto target. Accuracy degrades with distances from emitter.

**bias (accelerometer).** An accelerometer output when no acceleration is applied.

**binary chemical munition.** A munition in which chemical substances, held in separate containers, react when mixed or combined as a result of being fired, launched, or otherwise initiated to produce a chemical agent.

**biocatalysts.** (1) A biopolymer that accelerates a chemical reaction but is not consumed or otherwise altered during the process. Biocatalysts are enzymes, and the large majority are protein in nature. Catalysts do bind reactants, but the binding is transient. (2) Enzymes for specific chemical or biochemical reactions or other biological compounds which bind to and accelerate the degradation of CW agents. (WA)

**biological agent.** A microorganism that causes disease in personnel, plants, or animals, or causes the deterioration of material. (JP 1-02)

**biological defense.** The methods, plans, and procedures involved in establishing and executing defensive measures against attacks using biological agents. (JP 1-02)

**biologically based power cells.** The generation of electrical power using plant or microbial systems or mimetics of biological systems.

**biological safety levels.** (Biosafety Level 1 to Biosafety Level 4.) The use of biological pathogens in U.S. laboratories is regulated by policies and standards established by the Public Health Service. These are described in detail in HHS Publication No. (CDC) 93-8395, *Biosafety in Microbiological and Biomedical Laboratories*, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, and the National Institutes of Health, 3rd Edition, March 1993.

**biological weapon.** An item of materiel which projects, disperses, or disseminates a biological agent including arthropod vectors. (JP 1-02)

**Biological Weapons Convention (BWC).** An international agreement in which parties agree not to develop, produce, stockpile, or acquire biological agents

or toxins “of types and in quantities that have no justification for prophylactic, protective, and other peaceful purposes,” as well as related weapons and means for delivery. It was signed on April 10, 1972, and entered into force on March 26, 1975.

**biomimetics.** The study and process of optimizing functions in nature to look for design solutions in biology.

**biopolymers.** Biological macromolecules as follows: “enzymes,” “antibodies,” “monoclonal,” “polyclonal,” or “anti-idiotypic,” specially designed or specially processed “receptors.” (WA)

**bioregulation.** Regulation of physiological functions.

**biosensor.** An electronic device that uses biological molecules to detect specific chemical or biological substances.

**black powder (BP).** A low explosive consisting of an intimate mixture of potassium or sodium nitrate, charcoal, and sulphur. It is easily ignited and is friction sensitive (but not as sensitive as primer mixes). It is not intended to be initiated by friction in ammunition items. Formerly extensively used as a military propellant, but now its military use is almost exclusively in propellant igniters and primers, in fuzes to give short delay, in powder train time fuzes, in blank ammunition, and as spotting charges in practice ammunition.

**black body.** A perfect emitter (radiator) of electromagnetic radiation having a characteristic temperature that is the sole determinant of its radiated energy spectrum. An ideal body that completely absorbs all radiant energy striking it and therefore appears perfectly black at all wavelengths. The radiation emitted by such a body when heated is referred to as blackbody radiation. A perfect black body has an emissivity of unity.

**blank ammo.** An indication that ammunition does not contain projectile but does contain a charge of low explosive, such as black powder, to make a noise.

**blast.** The brief and rapid movement of air, vapor, or fluid away from a center of outward pressure.

**blister agent.** An agent that burns and blisters the skin, eyes, respiratory tract, or lungs. See also **vesicant**.

**blood agent.** An agent that prevents the normal transfer of oxygen from the blood to body tissues.

**blood oxygen saturation.** The percent of the oxygen-binding sites on hemoglobin that are bound to oxygen. This is the percent of oxygen-carrying capacity that is being used and, therefore, the pressure of oxygen reaching the cells. It is determined non-invasively by an oximeter placed on a finger or toe digit.

**booster.** (1) Assembly of metal parts and explosive charge provided to augment the explosive component of a fuze, causing detonation of the main explosive charge of the munition. May be an integral part of the fuze. The explosive in the booster must be sufficiently sensitive to be actuated by the small explosive elements in a fuze and powerful enough to cause detonation of the main explosive filling. (2) Auxiliary propulsion system, used in the early launching phase of a missile, in addition to the principal propelling means. It may be released from the missile when its impulse has been delivered.

**boresafe fuze.** Type of fuze having an interrupter in the explosive train that prevents a projectile from exploding until after it has cleared the muzzle of a weapon. (DoD, NATO). See also **fuze**.

**bridge.** A device which connects two separate LANs.

**brilliant munition.** A “many-on-many” munition that operates autonomously to search for, detect, identify, acquire, and attack specific classes of targets. The sensor on each munition acquires and attacks only one among the class of targets, so that in a battlefield situation two munitions do not attack the same target, thus leaving others inviolate. See also **sentient munition**.

**broadband brain activity.** Electrical activity of the brain as recorded by scalp electrodes. These recordings are of the electroencephalographic type and not necessarily coupled to externally generated stimuli. See also **evoked potentials**.

**bulk.** A comparatively large quantity of a substance or commodity that is manufactured, shipped, and stored as such, but which is characteristically broken down into smaller lots before application or further processing.

**burnout (electronics).** A type of failure that implies the destruction of a component caused by a permanent change in one or more characteristics beyond an acceptable amount.

**C3I System.** See **integrated C3I systems**.

**CAD (computer-aided design).** The use of a computer and computer graphics in the design of parts, products, and others.

**CAD/CAM.** A specialized suite of integrated applications wherein the output of the computer-aided design process conforms to the input requirements of the computer-aided manufacturing process.

**CAE (computer-aided engineering).** Computer systems (software) that analyze designs for basic error checking or to optimize manufacturability, performance, and economy (for example, by comparing various possible materials or designs). Information drawn from the CAD/CAM design database is used to analyze the

functional characteristics of part, product, or system under design and to simulate its performance under various conditions.

**calorie.** The amount of heat required to raise the temperature of 1 g of water 1 °C at temperatures from 1 °C to 100 °C at 760-mm Hg pressure.

**CAM (computer-aided manufacturing).** The use of computer and digital technology to generate manufacturing-oriented data. Data drawn from a CAD/CAM database can assist in or control a portion or all of a manufacturing process, including numerically controlled machines, computer-assisted parts programming, computer-assisted process planning, robotics, and programmable logic controllers. CAM can involve production programming, manufacturing engineering, industrial engineering, facilities engineering, and reliability engineering (quality control). CAM techniques can be used to produce process plans for fabricating a complete assembly, to program robots, and to coordinate plant operation.

**camming (axial displacement).** Axial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle faceplate, at a point next to the circumference of the spindle faceplate. (Reference: ISO 230.1 1986, paragraph 5.63.) (WA)

**cap, blasting.** A small tube, usually copper or aluminum, closed at one end and loaded with a charge or charges of high explosives, at least one of which is capable of detonating from the spit or sparks from the safety fuse. Electric blasting caps are blasting caps provided with a means for electrical firing.

**cardiac electrical responses.** Electrical signals detected from electrodes placed on the chest.

**cassette mutations.** The genome of yeast contains silent loci on each side of certain genes that code for specific proteins. During cell division, the active gene is excised, and a new copy of the silent locus is inserted. Genetic engineers can take advantage of this cassette mechanism to insert a gene of choice in the yeast genome and thereby produce a desired protein in the microorganism.

**cathodic arc deposition.** See **thermal evaporation-physical vapor deposition (TE-PVD)**.

**cell adhesion molecules (adherins, integrins, laminins).** Proteins present on the surface of living cells at particular stages of normal development. These proteins permit cells to recognize other cells in normal development and become organized into organ systems. Mutant cells missing the genetic information for such adhesion proteins can give rise to cancers, malformed organs, and other anomalies.

**cell lines.** Intact biological cells from a defined source. The cells can be modified to produce monoclonal antibodies or to respond to a specific chemical/biological agent by emitting light, producing a specific chemical, or emitting an electrical signal.

**CEP.** Circular error probable or circle of equal probability. A measure of accuracy at a specific range, expressed in terms of the radius of the circle, centered on the target, in which 50 percent of the payloads impact.

**chaperone proteins.** Proteins made by normal cells that function to control the three-dimensional (3-D) folding of newly synthesized proteins in cells. The chaperone proteins permit the folding process to proceed at a controlled rate and thereby diminish the inappropriate folding or denaturation of cell proteins. Heat shock proteins are one class of chaperones.

**Chemical Abstract Service (CAS) registry number.** A unique number which links the molecular structure of a chemical with its Chemical Abstracts index name and other data. Each number designates a single substance so far as its structure has been elucidated and can be defined in terms of atoms (composition), valence bonds (structure), and stereochemistry.

**chemical agent.** A chemical substance which is intended for use in military operations to kill, seriously injure, or incapacitate personnel through its physiological effects. The term excludes riot control agents, herbicides, smoke, and flame (JP 1-02). (Note that the USML definition is more inclusive than the JointPub 1-02 definition). See also **chemical warfare agent**.

**chemical defense.** The methods, plans, and procedures involved in establishing and executing defensive measures against attack utilizing chemical agents. (JP 1-02)

**chemical laser.** A “laser” in which the excited species is produced in a chemical reaction. The excited species is usually an atom or molecule which is left in a metastable state during the chemical reaction of the initial compounds.

**chemical vapor deposition (CVD).** A process of depositing reaction products from a gaseous chemical reaction. The process can consist of depositing very thick bulk material. CVD is also an overlay coating or surface modification coating process wherein a metal, alloy, “composite,” dielectric, or ceramic is deposited upon a heated substrate. Gaseous reactants are decomposed or combined in the vicinity of a substrate, resulting in the deposition of the desired elemental, alloy, or compound material on the substrate. Energy for this decomposition or chemical reaction process may be provided by the heat of the substrate, a glow discharge plasma, or “laser” irradiation.

**chemical warfare agent.** A chemical substance which, because of its physiological, psychological, or pharmacological (chemical agent) effects, is intended for use in military operations to kill, seriously injure, or incapacitate humans (or animals) through its toxicological effects. Excluded are riot control agents, chemical herbicides, and smoke and flame materials. Chemical agents are nerve agents, incapacitating agents, blister agents (vesicants), lung-damaging agents, blood agents, and vomiting agents.

**chemical weapon (CW).** “(a) Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes; (b) Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices; (c) Any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in subparagraph (b).” (CWC, Article II)

**Chemical Weapons Convention (CWC).** A multilateral treaty that bans the development, production, acquisition, stockpiling, retention, and direct or indirect transfer of chemical weapons. It also prohibits the use or preparation for use of CW and the assistance, encouragement, or inducement of anyone else to engage in activities prohibited by the treaty.

**Chemical Weapon Convention (CWC) Schedules.** In the CWC, the three categories into which toxic chemicals and their precursors are divided based on the threat the chemicals/precursors pose to the purpose and objectives of the treaty and the extent of their commercial use.

**chemotactic events.** The response of living cells to chemicals in the environment. Usually describing the swimming of bacteria toward (positive chemotaxis) or away from (negative chemotaxis) a specific chemical. The chemotactic event results from the interaction of the chemical in the medium with receptors in the living cell.

**chip.** A colloquial term used in the semiconductor industry that refers to a packaged or unpackaged integrated circuit.

**choking agent.** An agent that attacks the eyes and respiratory tract from the nose to the lungs, primarily causing pulmonary edema (“dry drowning”).

**cholinesterase.** An enzyme found in blood plasma that hydrolyzes choline esters.

**circadian synchronization.** The period of the biological cycle of the body approximates 25 hours, a circadian cycle. When the cycle is perturbed by travel across time

zones, performance decrement often occurs. Jet lag is the term given to such perturbation of the circadian cycle and resulting decrement in performance. The naturally occurring hormone melatonin regulates the body cycle. Jet lag affects the synthesis of melatonin, and the administration of melatonin can remedy jet lag. Behavioral, pharmacological, and nutritional techniques enable individuals to modify the clock in a controlled manner.

**circuit element.** A single active or passive functional part of an electronic circuit, such as one diode, one transistor, one resistor, one capacitor, etc. (WA)

**circumvention (electronics).** A system-protection technique in which detection of the onset of nuclear radiation or EMP puts a critical portion of the system in a protected condition. A system-level technique using special hardware and software for recovering from a transient upset.

**civil aircraft.** Those "aircraft" listed by designation in published airworthiness certification lists by the civil aviation authorities to fly commercial civil internal and external routes or for legitimate civil, private, or business use. (WA). See also **aircraft**.

**cluster tool.** A set of process chambers or modules linked by a wafer transport, in a controlled environment, and with a communication system that can control sequential processing in a semiconductor fabrication line.

**combinatorial chemistry.** Methods of synthesizing rapidly large numbers of peptides, polynucleotides, or other low-molecular-weight compounds. Thousands to millions of compounds can be synthesized simultaneously in hours. These compounds are synthesized in solution or on a solid-state matrix. The resulting compounds can be tested for highly selective and high affinity binding to biological/ chemical agents, to biological receptors, or to portions of genetic materials. Because of their binding properties, the compounds or the information obtained from their use can be used in the design and fabrication of sensors, pharmaceuticals, behavior modifiers, and food stabilizers. As described in an article by James Krieger, *C&EN*, May 12, 1997, p. 30, "combinatorial chemistry generates lead compounds that could exhibit biological activity against a particular target.... For drug hunters, helping to identify targets is a function of bioinformatics. That branch of computer-based information management deals with genomic information, from gene discovery to DNA and protein sequence...." Companies involved include MSI; Oxford Molecular Group, California; and MDL Information Systems, California. The conceptual framework for this emerged in part from the work of Merrifield at Rockefeller University in the early 1970's.

**combinatorial genetics.** The creation of mutant strains of organisms by taking advantage of naturally occurring processes that allow the genetic material DNA to be moved from one region on a chromosome to another region on the chromosome or on a different chromosome. The regions of DNA that can be moved are called transposable elements. When transposable elements are inserted in the region of exons (pieces of DNA that are read out and produce protein products), a new gene can be created. This process is called exon shuffling.

**command-line-of-sight (CLOS).** A form of command-guidance system in which commands are automatically generated by continually comparing the aimpoint to the current missile location. Corrective commands are transmitted to the missile through a link causing the missile to fly to the target (for example, the TOW missile and fiber-optical-guided missile, FOG-M).

**commingled yarn.** A hybrid yarn made with two types of intermingled filaments; e.g., thermoplastic filaments intermingled with carbon filaments to form a single yarn.

**comminution.** A process to reduce a material to particles by crushing or grinding. (WA)

**common channel signaling.** A signaling method in which a single channel between exchanges conveys, by means of labeled messages, signaling information relating to a multiplicity of circuits or calls and other information such as that used for network management. (WA)

**communications.** The process of representing, transferring, interpreting, or processing information (data) among persons, places, or machines. Communications implies a sender, a receiver, and a transmission medium over which the information travels. The meaning assigned to the data must be recoverable without degradation. See also **telecommunications**.

**communications channel controller.** The physical interface which controls the flow of synchronous or asynchronous digital information. It is an assembly that can be integrated into computer or telecommunications equipment to provide communications access. (WA)

**compensation (TREE).** A general category of techniques employed to divert primary and secondary photocurrents or to nullify their effects as an aid to circuit hardening against ionizing radiation.

**component.** An item which is useful only when used in conjunction with an end item. A major component includes any assembled element which forms a portion of an end item without which the end item is inoperable. (Example: Airframes, tail sections, transmissions, tank treads, hulls, etc.) A minor component includes any

assembled element of a major component. (ITAR, Sec 121.8)

**composite.** A “matrix” and an additional phase or additional phases consisting of particles, whiskers, fibers, or any combination thereof present for a specific purpose or purposes. (WA)

**composite theoretical performance (CTP).** A measure of computational performance given in millions of theoretical operations per second (MTOPS), calculated using the aggregation of “computing elements (CE).” (WA)

**compound rotary table.** A table allowing the workpiece to rotate and tilt about two nonparallel axes, which can be coordinated simultaneously for “contouring control.” (WA)

**computer-operating area.** The immediate contiguous and accessible area around the electronic computer, where the normal operating, support, and service functions take place.

**computing cluster.** A computer system consisting of multiple central processing units interconnected by a switch matrix for the purpose of distributing and sharing workload to solve a single computational problem.

**computing element (CE).** The smallest computational unit that produces an arithmetic or logic result. (WA)

**contamination.** (1) The deposit, absorption, or adsorption of radioactive material, or of biological or chemical agents on or by structures, areas, personnel, or objects. (2) Food and/or water made unfit for consumption by humans or animals because of the presence of environmental chemicals, radioactive elements, bacteria or organisms, the byproduct of the growth of bacteria or organisms, the decomposing material (to include the food substance itself), or waste in the food or water. (JP 1-02)

**continuous wave (CW).** Energy delivered with pulses lasting longer than 1 second.

**contouring control.** Two or more “numerically controlled” motions operating in accordance with instructions that specify the next required position and the required feed rates to that position. These feed rates are varied in relation to each other so that a desired contour is generated. (Reference: ISO/DIS 2806-1980.) (WA)

**conventional unguided projectiles.** Any of a variety of unpropelled projectiles designed to follow a ballistic path from launch to impact, deployment, or initiation of the lethal mechanism.

**correlated munition.** See **sentient munition.**

**corrosion-resistant steel.** Steel which is AISI (American Iron and Steel Institute) 300 series or equivalent national standard steels.

**critical temperature.** (Sometimes referred to as the transition temperature of a specific “superconductive” material.) The temperature at which the material loses all resistance to the flow of direct electrical current. (WA)

**cruise missile.** An unmanned, self-propelled, guided vehicle that sustains flight through aerodynamic lift for most of its flight path and whose primary mission is to place an ordnance or special payload on a target.

**cryptanalysis.** (1) The solving (breaking) of codes and ciphers. (2) The steps or processes involved in converting encrypted messages into plaintext without initial knowledge of the system or key employed in the encryption (the official intelligence-community definition: Carl, Leo D., *International Dictionary of Intelligence*, International Defense Consultant Services, Inc., McLean, Virginia, 1990). (3) The analysis of a cryptographic system or its inputs and outputs to derive confidential variables or sensitive data, including clear-text [ISO 7498-2-1988 (E), paragraph 3.3.18]. (4) The steps and operations performed in converting encrypted messages into plain text without initial knowledge of the key employed in the encryption. (JCS Pub 1-02)

**cryptography.** (1) The encoding, enciphering (encryption) and decoding and deciphering (decryption) of messages using codes and ciphers. Cryptography thus becomes a function of communications. (2) The discipline that embodies principles, means, and methods for the transformation of data to hide its information content, prevent its undetected modification, prevent its unauthorized use, or a combination thereof. (ANSI X9.42 and ANSI X9.57 Draft). (WA) (3) The branch of cryptography used to provide a means of encryption and decryption of plaintext so that its meaning may be concealed. (This is the official intelligence community definition: See Carl, Leo D., *International Dictionary of Intelligence*, International Defense Consultant Services, Inc., McLean, Virginia, 1990). (4) The enciphering of plaintext so that it will be unintelligible to an unauthorized recipient (Final Report, Senate Select Committee on Intelligence, 26 April 1976). (5) The discipline that embodies principles, means, and methods for the transformation of data to hide its information content, prevent its undetected modification, or prevent its unauthorized use. Cryptography is limited to the transformation of information using one or more secret parameters (e.g., cryptovariables) or associated key management. A “secret parameter” is a constant or key kept from the knowledge of others or shared only within a group. (*The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods*

*and Technologies*, Final Version, Initial Elements, List of Dual-Use Goods and Technologies and Munitions List, 1 August 1996)

**cryptology.** (1) The study or science of codes and ciphers. (2) The science of producing signals intelligence [SIGINT] and maintaining signals security (official intelligence community definition: Carl, Leo D., *International Dictionary of Intelligence*, International Defense Consultant Services, Inc., McLean, Virginia, 1990). (3) The science of secret communications [Federal Bureau of Investigation (FBI) Glossary]. (4) The science that deals with hidden, disguised, or encrypted communications. It includes communications security and communications intelligence (Joint Pub 1-02). (Note: The collective term “cryptology” conventionally includes both cryptography and cryptanalysis topics.)

**cryptomaterial.** All material including documents, devices, equipment, and apparatus essential to the encryption, decryption, or authentication of telecommunications. When classified, it is designated CRYPTO and subject to special safeguards. (JP 1-02)

**cyanation.** A reaction in which a cyanide group is added. For CWC purposes, a cyanide group is bonded to a phosphorus atom.

**cyberspace.** A notional environment in which digitized information is communicated over computer networks (JP 1-02)

**cytochrome P 450.** A family of enzymes involved in metabolic detoxication of xenobiotics. These enzymes serve as biomarkers of toxicant exposure.

**data.** Representations such as characters, symbols, or analog quantities that may or may not explicitly relate to or describe a material or immaterial entity or process.

**data device.** Equipment capable of transmitting or receiving sequences of digital information.

**data fusion.** A technique in which data from multiple, and perhaps diverse, sensors are correlated into digitally formatted products.

**decoder.** (1) A device that decodes data. (ISO) (2) A device that has a number of input lines of which any number may carry signals and a number of output lines of which not more than one may carry a signal, there being a one-to-one correspondence between the outputs and the combination of the input signals. (ISO) (3) Contrast with “encoder.” (4) See also **operation decoder.** (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM, 1981)

**decontamination (DECON).** The process of making any person, object, or area safe by absorbing,

destroying, neutralizing, making harmless, or removing chemical or biological agents or by removing radioactive material clinging to or around it.

**defense service.** (1) The furnishing of assistance (including training) to foreign persons, whether in the United States or abroad, in the design, development, engineering, manufacture, production, assembly, testing, repair, maintenance, modification, operation, demilitarization, destruction, processing, or use of defense articles; or (2) the furnishing to foreign persons of any [controlled] technical data whether in the United States or abroad. (ITAR, Sec. 120.9)

**deflagration (energetic materials).** An exothermic chemical reaction proceeding at subsonic velocity along the surface of an explosive and producing hot gases at high pressure. Generally accompanied by vigorous production of heat flames, as well as sparks and spattering of burning materials.

**deflagration to detonation transition (DDT).** The transition of a deflagration reaction into a sustainable detonation reaction due to an increase in the temperature or pressure of the reaction.

**defoliant.** A chemical which causes trees, shrubs, and other plants to shed their leaves prematurely (JP 1-02).

**demodulator.** A functional unit that converts a modulated signal into the original signal. Contrast with “modulator.” (*Vocabulary for Data Processing, Telecommunication, and Office Systems*, Seventh Edition, IBM, 1981)

**Denier.** A numbering system in which the denier number is numerically equal to the weight in grams of 9,000 m yarn or filament.

**designed or modified.** Equipment, parts, components, or software that, as a result of “development or modification,” have specified properties that make them fit for a particular application. The designed or modified equipment, parts, components, or software can be used for other applications. For example, a titanium-coated pump designed for a missile can be used with corrosive fluids other than propellants. (MTCR.)

**detection quotient.** The ratio of true detections to the total mines present multiplied by the ratio of the true detections to the sum of true detections and false detections.

**detonating cord.** A waterproof, flexible fabric tube containing a high explosive designed to transmit the detonation wave.

**detonation (high-explosive).** A violent and complete chemical reaction proceeding at supersonic velocity within an explosive, generating gases at extremely high pressure and temperature. The sudden and enormous

pressure of hot gases violently disrupts the surrounding media, and a shock wave is propagated at supersonic velocity.

**detonation, nuclear.** A nuclear explosion resulting from fission or fusion reactions in nuclear materials, such as that from a nuclear weapon.

**detonator.** (1) An explosive train component that can be activated by either a nonexplosive impulse or a primer and can reliably initiate high-order detonation in a subsequent high-explosive component of the train. When activated by a nonexplosive impulse, a detonator includes a primer. In general, detonators are classified by method of initiation, such as percussion, stab, electric, flash, etc. See specific definitions. (2) An explosive charge placed in certain equipment and set to destroy the equipment under certain conditions.

**detonator, electric.** Electrical leads and explosive elements for detonating an explosive charge.

**detonator, friction.** A blasting cap fuse and a pull fuse lighter for detonating an explosive charge.

**detonator, percussion.** A blasting cap and explosive elements designated for detonating an explosive charge.

**detonator, stab.** A detonator that initiates the detonation wave in the explosive train by a pin stab.

**Developing Critical Technologies (DCT).** Technologies which will produce increasingly superior performance of military systems or maintain a superior capability more affordably.

**di/dt.** The change in current with respect to time. Also known as rise time or decay time. For switches, it is the maximum rate of current rise that a switch can tolerate.

**digital computer.** Equipment which can, in the form of one or more discrete variables, accept data, store data or instructions in fixed or alterable writable storage devices, process data by means of a stored sequence of instructions which is modifiable, and provide output of data. (WA)

**digitizing rate.** The rate (in samples per second) at which the acquired signal can be converted to digital information.

**discrete component.** A separately packaged circuit element with its own external connection. (WA)

**DNA.** Deoxyribonucleic acid: the genetic material of all organisms and viruses (except for a small class of RNA-containing viruses) that code for structures and is used in normal metabolism.

**DNA computing.** The use of a large set of specific polynucleotides—in a solution coated on a surface—that can recognize and bind specific complementary

polynucleotide sequences and generate a signal (optical/electrical) indicating that such recognition has occurred. A solid DNA chip may contain 400,000 fields, each containing millions of DNA fragment molecules. These materials can be used as sensors for B agents, as detectors of human genomic sequences, or in mathematical computations.

**Doppler broadening.** The special radiation line broadening attributable to the random motion of the atomic, molecular, or nuclei source. The effect is brought about when individual radiating sources have different velocities with respect to the observer and therefore give rise to different Doppler frequency shifts being observed, causing a broadening of the spectral signature.

**Doppler effect.** The effect produced on a wave frequency due to the relative motion of a source, or of the target, and sensed by detection and tracking systems.

**dose.** The dose is the quantity of the compound received by the subject.

**dose, absorbed.** The amount of energy imparted by nuclear (or ionizing) radiation to unit mass of absorbing material. The unit is the rad. In current usage, the rad unit has been replaced by the SI unit, the gray (Gy) (1 Gy = 100 rads).

**drift.** (1) Environmental or thermal effects on response of a machine or device to gradually move away from the desired response. (2) A gradual deviation from a set adjustment, such as a frequency of balance current, or from a direction. (3) Lateral component of vehicle motion due to crosswind or to gyroscopic action of spinning projectile.

**drift rate (gyro).** The time rate of output deviation from the desired output. It consists of random and systematic components and is expressed as an equivalent input angular displacement per unit time with respect to inertial space. (WA)

**dv/dt.** The change in voltage with respect to time. For switches, it is the maximum rate of voltage rise that will not turn the switch on.

**dynamic adaptive routing.** Automatic rerouting of traffic based on sensing and analysis of current actual network conditions. (WA)

**dynamic signal analyzers.** “Signal analyzers” which use digital sampling and transformation techniques to form a Fourier spectrum display of the given waveform, including amplitude and phase information. (WA) See also **signal analyzer**.

**dynamite, military.** Dynamite that is unique in its high RDX content (75 percent), which results in a detonation velocity of around 20,000 fps.

**electro-explosive device.** An explosive or pyrotechnic component that initiates an explosive, burning, electrical, or mechanical train and is activated by the application of electrical energy. Also called EED. (JP 1-02)

**electro-optics.** The science and technology concerned with the use of applied electrical fields to generate and control optical radiation. See also **optoelectronic**.

**electron beam PVD.** See **thermal evaporation-physical vapor deposition (TE-PVD)**.

**electronically steerable phased-array antenna.** An antenna consisting of an array of individual radiating or receiving elements in which the signal feeding (or captured by) each element is varied in phase or time delay such that directional antenna beams can be formed and scanned very rapidly in space.

**electronic countermeasures (ECM).** Offensive or defensive tactics or devices using electronic and reflecting apparatus to reduce the military effectiveness of enemy equipment involving electromagnetic radiation, such as radar, communications, guidance, or other radiowave devices.

**encoder. (1)** A device that encodes data. (ISO) **(2)** A device that has a number of input lines of which not more than one at a time may carry a signal and a number of output lines of which any number may carry signals, there being a one-to-one correspondence between the combination of output signals and the input signals. (ISO) **(3)** Contrast with “decoder.” (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM 1981)

**end effectors.** Includes grippers, active tooling units, and any other tooling that is attached to the baseplate on the end of a “robot” manipulator arm. (WA)

**end-item.** An assembled article ready for its intended use. Only ammunition, fuel, or another energy source is required to place it in an operating state. (ITAR, Sec. 121.8)

**energetic materials.** A collective term for any of a variety of explosive, propellant, or pyrotechnic materials, generally characterized by the ability to release energy at very rapid rates through chemical reaction or change of physical state.

**ensembling.** A process to improve clock performance by using multiple clocks and to improve reliability by redundancy, self-monitoring, or reduction of signal perturbations.

**environment (service).** All external conditions, whether natural or induced, to which items or materials are likely to be subjected throughout their life cycle.

**enzymes.** “Biocatalysts” for specific chemical or biochemical reactions.

**Eotvos.** A unit of measure that is equal to 1 nano Galileo per centimeter or  $10^{-9}$ Gal/cm.

**equivalent density (optics).** The mass of an optic per unit optical area projected onto the optical surface. (WA)

**evoked potentials.** As a group, evoked potentials are electrical signals that are detected from electrodes placed on the scalp. The electrical signals are a response to neural activity generated by externally driven sensory stimuli.

1. *Auditory evoked potential.* Electrical signals reflecting the firing of large numbers of neurons in the auditory pathway (from ear to auditory cortex) in response to discrete sound stimulation. The auditory responses are signal averaged. The interval of the response is generally in the 50- to 350-millisecond period after presentation of the sound.
2. *Visual evoked potential.* Electrical signals reflecting the firing of large numbers of neurons in the visual pathway (from eye to visual cortex) in response to discrete visual stimulation. The responses are signal averaged. The interval of the response is generally in the 50- to 350-millisecond period after presentation of the stimulus.

The amplitude of the evoked response is indicative of arousal or attention.

**exploder.** A device designed to generate an electric current in a firing circuit after deliberate action by the user in order to initiate an explosive charge or charges. (DoD, NATO)

**explosive ordnance.** All munitions containing explosives, nuclear fission or fusion materials, and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles, artillery, mortar, rocket, and small arms ammunition; all mines, torpedoes, and depth charges; demolition charges; pyrotechnics; clusters and dispensers; cartridge- and propellant-actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature. (DoD, NATO)

**explosive train.** A succession of initiating and igniting elements arranged to cause a charge to function. (DoD, NATO)

**explosively driven penetrator.** A type of anti-armor weapon in which the lethal mechanism is both formed by and derives its energy from a chemical explosive.

The exact configuration and ballistic performance of the penetrator are determined by the energetic properties of the explosive and the physical properties and initial configuration of the liner.

**explosively formed (or forged) penetrator.** A type of explosively driven penetrator, characterized by a relatively shallow initial liner, which forms a solid slug with ballistic properties such that the warhead is effective when initiated at standoff distances of tens of meters or greater.

**expression vectors.** Carriers (e.g., plasmid or virus) used to introduce genetic material into host cells. (WA)

**extra-national groups.** Groups that are not generally bound by the same constraints and mores or motivated by the same factors as nation-states. In some cases they cross national or regional boundaries; they are also referred to as transnational groups.

**extranational organizations.** See extra-national groups.

**fault tolerance.** The capability of a computer system, after any malfunction of any of its hardware or “software” components, to continue to operate without human intervention, at a given level of service that provides continuity of operation, data integrity, and recovery of service within a given time. (WA)

**femto.** A unit of measure that is equal to 1 times  $10^{-15}$ .

**fibrous and filamentary materials.** These materials include continuous monofilaments; continuous yarns and rovings; tapes, fabrics, random mats and braids; chopped fibers, staple fibers, and coherent fiber blankets; whiskers, either monocrystalline or polycrystalline, of any length; and aromatic polyamide pulp. (WA)

**film-type integrated circuit.** An array of “circuit elements” and metallic interconnections formed by deposition of a thick or thin film on an insulating “substrate.” (WA)

**firmware.** (1) Implementation of software in hardware circuitry or read-only memory. (2) Includes, but is not limited to, circuits into which software has been programmed. (ITAR, Sec. 121.8)

**first responders.** Those who are the first to respond to an emergency situation, generally law enforcement, fire fighters, and emergency medical personnel.

**first-time-right.** Ability to manufacture items that conform to complicated engineering designs and to have the end product meet all specifications the first time.

**fixed.** The coding or compression (e.g., cryptographic or key variables) that cannot be modified by the user.

**fixed ammunition.** Ammunition rounds in which the cartridge with propellant and the loaded shell or bullet are all in one unit. With semifixed rounds the cartridge case is not permanently fixed to the projectile, so that zone charges within cases can be adjusted to obtain desired ranges, but each round is inserted into a weapon as a unit.

**fixed-sequence manipulation mechanisms.** Automated moving devices, operating according to mechanically fixed programmed motions. The program is mechanically limited by fixed stops, such as pins or cams. The sequence of motions and the selection of paths or angles are not variable or changeable by mechanical, electronic, or electrical means.

**forty hertz gamma phase.** An electrical pattern occurring in the brain that has the characteristics of firing at 40 cycles per second. Thought by some to be critical in learning and memory.

**frequency agility (frequency hopping).** A form of “spread spectrum” in which the transmission frequency of a single communication channel is made to change by discrete steps. (WA)

**frequency agility (radar).** See radar frequency agility.

**frequency switching time.** The maximum time (i.e., delay) taken by a signal, when switched from one selected output frequency to another selected output frequency, to reach a frequency within 100 Hz of the final frequency *or* an output level within 1 dB of the final output level. (WA)

**frequency synthesizer.** Any kind of frequency source or signal generator, regardless of the actual technique used, providing a multiplicity of simultaneous or alternative output frequencies, from one or more outputs, controlled by, derived from, or disciplined by a lesser number of standard (or master) frequencies. (WA)

**functional MRI.** See magnetic resonance imaging. Mapping the magnetic moment of regions in the brain that occur when a subject is placed in a magnetic field and then given a particular sensory stimulus or cognitive task. The signal is generated by changes in magnetic moment resulting from shifts in regional blood flow and dissociation of oxygen from hemoglobin. Provides images of neural function at a scale of 2 to 5 mm in resolution.

**fuse.** A term for an igniting or explosive device in the form of a cord, consisting of a flexible fabric tube and core of low or high explosive. Used for blasting and demolition and in certain munitions. A fuse with black powder or other low-explosive core is called a blasting time fuse. A fuse with PETN or other high-explosive core is called detonating cord.

**fuse, blasting, time.** A flexible, water-resistant, fabric-covered cord containing a black powder core that burns at a known rate, providing a time delay proportional to the length of fuse. Used for igniting a blasting cap or an explosive charge.

**fuze.** A device which initiates an explosive train of fire or detonation in ammunition by an action such as hydrostatic pressure, electrical energy, chemical action, impact, mechanical time, or a combination thereof. Fuzes are used primarily in bombs and projectiles. (DoD, NATO). See also **boresafe fuze, impact action fuze, proximity fuze, self-destroying fuze, shuttered fuze, time fuze.**

**Galileo (Gal).** The unit of acceleration of gravity, equal to 1 cm/sec<sup>2</sup>.

**gas atomization.** A process to reduce a molten stream of metal alloy to droplets of 500- $\mu$ m diameter or less by a high-pressure gas stream. (WA)

**gene.** A sequence of nucleic acids in the DNA molecules representing the genetic code for the production of one or more proteins in a living cell.

**gene expression.** The process by which a portion of the cell's entire genome is actively transcribing deoxyribonucleic acid (DNA) to messenger ribonucleic acid (mRNA). The mRNA is then translated to protein.

**gene fragments.** Small pieces of genes (a sequence of polynucleotides 20 to 30 bases long) that are characteristic of specific animals, bacteria, and viruses. Can be used to construct sensors.

**genes.** Units of inheritance that code for specific proteins. From a chemical perspective, they are polynucleotides (DNA) or polyribonucleotides (RNA).

**gene sequencing.** Rapid gene sequencers, based on fluorescent probe tagging of polynucleotides and subsequent separation by gel electrophoresis. Currently involves the processing of 400,000 bases per hour and the analysis of 8,000 bases per 16 hours. This system can determine the sequence of about 2 million bases per several months (this is much slower than the automated steps because of technical difficulties). A second strategy uses variants of mass spectrometry to sequence DNA. See also **mass spectroscopy.**

**genetic engineering.** The development and application of scientific methods, procedures, and technologies that permit direct manipulation of genetic material to alter the hereditary traits of a cell, organism, or population.

**Geneva Protocol of 1925.** A multilateral agreement that prohibits the use of poisonous gases and bacteriological weapons in war. It was opened for signature in 1925 and was ratified by the United States in 1975.

**genome.** (1) A term referring to all the genes in a given organism. (2) One haploid set of chromosomes with the genes they contain (WNI, Vol. 1).

**geographically dispersed.** (1) Consisting of elements that are geographically separated and typically assigned some level of autonomous function within a defined area. (2) Sensors are considered "geographically dispersed" when each location is distant from any other more than 1,500 m in any direction. Mobile sensors are always considered "geographically dispersed." (WA)

**giant magnetoresistance.** Metal sandwich formed from thin magnetic layers separated by nonmagnetic metal spacers of a few atoms thickness.

**global interrupt latency time.** The item taken by the computer system to recognize an interrupt due to the event, service the interrupt, and perform a context switch to an alternative memory-resident task waiting on the interrupt. (WA)

**glutathione S transferases.** A family of multifunctional enzymes involved in metabolic detoxication of electrophilic xenobiotics. The xenobiotics may be environmental toxicants (e.g., metals, such as lead, mercury, and depleted uranium). These enzymes serve as biomarkers of toxicant exposure.

**grandmother cell.** A hypothesized neuron in the brain that fires when a specific object is recognized by a person. The hypothesis is that when this cell fires, the person identifies the object in the visual field as a unique entity (his/her grandmother, parent, and so forth).

**Gray.** The gray (Gy) is a unit of absorbed dose of ionizing radiation; one Gy is an absorbed dose of ionizing radiation equal to one joule per kilogram of absorber. The gray replaces the rad. One rad = 0.01 Gy.

**grenade.** A small explosive or chemical missile, originally to be thrown by hand, but now also to be projected from special grenade launchers, usually fitted to rifles or carbines. Grenades may be classified as either rifle or hand. Many variations of these have been used, including improvisations.

**G-series nerve agents.** This series of nonpersistent nerve agents includes tabun, sarin, soman, and GF. They are organophosphorus compounds that inhibit action of a key nervous system enzyme (acetylcholinesterase).

**guidance.** Control of trajectory, especially that of unmanned, or of manned but guided according to external inputs. See also **beam-rider guidance, electro-optics, laser, passive homing, semi-active.**

**guidance munition.** A "one-on-one" munition: a specific munition engages a specific target, which is advantageous during close-combat situations. An

operator is required in the loop to select the target and often assist in the guidance. The munitions may be either CLOS or “terminal homing” devices.

**guidance sets.** A device that integrates the data collection and command process that directs a missile or space vehicle to its target.

**guidance system.** A complete system providing guidance to the flight-control system which steers the vehicle.

**GUNN.** A two-terminal semiconductor device that utilizes the GUNN effect to produce microwave oscillation or to amplify an applied microwave signal.

**haptic device.** A force feedback system that permits a user to experience a sense of touch (haptics) when interacting with a computer-driven interface. Haptics and virtual reality have applications in driving simulators and telemedicine and training for surgery.

**heat shock proteins (HSPs).** One family of proteins that serve as molecular chaperones. See also **chaperone proteins**.

**hebbian circuit.** An electrical firing pattern in the brain caused by increase in efficacy of synaptic communication when the pre- and post-synaptic neurons fire simultaneously.

**helmet-mounted display (HMD).** A visualized display in a portion of the system operator’s field of view that allows miniature electric circuits to represent real-world information. Two example technologies include chromophores to form icons representing critical information and fiber-optic systems.

**hexapod.** A machine tool with a variable triangulated frame that controls the position of the cutting tool with six degrees of freedom.

**high-energy laser (HEL).** A laser which has an average pulsed or continuous wave (CW) power level of nominally tens of kilowatts and which operates for nominally a few seconds, providing energies of  $10^4$  joules or larger. When the HEL is operated in a pulsed mode, the energy is averaged over 1 second or the duration of the laser train of pulses, whichever is longer.

**hit to kill.** A munition system incorporating integrated seeker, guidance and control, and fuze subsystems, the warhead of which is initiated upon target impact or in close proximity thereto.

**hot isostatic densification.** A process of pressurizing a casting at temperatures exceeding 375 K (102 °C) in a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal force in all directions to reduce or eliminate internal voids in the casting. (WA)

**human genome.** The total genetic information encoded in the DNA of humans.

**Human Genome Project.** A current multinational effort that will identify all the genetic components of humans by the year 2003. These include susceptibility to disease, neural function, and genetic determinants of behavior.

**hydrogels (hydrophilic polymer gel systems.)** The polymers may be of natural origin (chitosan) or mixtures of natural polymers with biocompatible polymers, such as polyvinylpyrrolidone (PVP). The hydrogels can be used to deliver drugs in slow-release form or can be used to reduce bleeding by injection into wounds.

**hybrid computer.** Equipment which can accept and process data in both analog and digital representations and provide output of data. (WA)

**hybrid electric vehicle.** Vehicles combining power generation aspects through traditional and electrical technologies.

**hybrid integrated circuit.** Any combination of integrated circuit(s), or integrated circuit with “circuit elements” or “discrete components” connected to perform specific function(s), and having all of the following characteristics: containing at least one unencapsulated device, connected using typical IC production methods, replaceable as an entity, *and* not normally capable of being disassembled. (WA)

**hydrostatic.** Bearings in which the moving part is supported by liquid pressure.

**hypervelocity.** Pertaining to velocities in excess of Mach 5.

**hyphenation.** The merging of analytical chemistry techniques.

**IC<sub>t50</sub>.** The IC<sub>t</sub> (incapacitating concentration time)<sub>50</sub> is the time in which 50 percent of the exposed population will be incapacitated.

**ID<sub>50</sub>.** The ID (incapacitating dose)<sub>50</sub> is the dose which incapacitates 50 percent of the exposed population.

**igniter.** Any chemical, electrical, or mechanical device used to ignite.

**image enhancement.** The processing of externally derived, information-bearing images by algorithms such as time compression, filtering, extraction, selection, correlation, convolution, or transformations between domains (e.g., fast Fourier transform or Walsh transform). This does not include algorithms using only linear or rotational transformation of a single image, such as translation, feature extraction, registration, or false coloration. (WA)

**impact action fuze.** A fuze that is set in action by the striking of a projectile or bomb against an object, e.g., percussion fuze, contact fuze. Synonymous with direct action fuze. (DoD, NATO) See also **fuze**.

**improvised explosive device.** A device placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic, or incendiary chemicals and designed to destroy, incapacitate, harass, or distract. It may incorporate military stores, but is normally devised from nonmilitary components. Also called IED. (JP 1-02)

**impulse, specific.** The thrust developed in burning unit weight of a propellant, corrected for standard operating and discharge pressures. Specific impulses may be measured, or they may be estimated theoretically from the thermochemical properties of propellant formulations and their decomposition products.

**impulse, total.** The integral of the thrust of a rocket motor over the burning time. Other factors being equal, the same total impulse can result from a small thrust over a long burn time as from a high thrust over a short burn time.

**in-bulk.** See **bulk**.

**incapacitation.** The state which is achieved when weapons effects result in physical inability (real or perceived) or mental disinclination to act in a hostile or threatening manner.

**incapacitating agent.** An agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort in the performance of their assigned duties. (JP 1-02)

**individual protective equipment.** Individual protective equipment (IPE) includes the chemical protective overgarment, mask equipment with hood, rubber butyl gloves, and booties.

**inertial environmental test conditions.**

- (1) Input random vibration with an overall “g” level of 7.7 g rms in the first half hour and a total test duration of 1-1/2 hour per axis in each of the three perpendicular axes, when the random vibration meets the following:
  - (a) A constant power spectral density (PSD) value of 0.04 g<sup>2</sup>/Hz over a frequency interval of 15 to 1,000 Hz; and
  - (b) The PSD attenuates with frequency from 0.04 g<sup>2</sup>/Hz to 0.001 g<sup>2</sup>/Hz over a frequency interval from 1,000 to 2,000 Hz.
- (2) A roll and yaw rate of equal to or more than +2.62 radian/s (150 deg/s).

- (3) According to national standards equivalent to (1) or (2) above.

**information.** Characteristics, quantities, properties, designators, or instructions (elements of information) of any material or immaterial entity or process.

**information communications.** Capability to move or transfer information from one location to another.

**information exchange.** Capability to switch, direct route, multiplex, or inverse-multiplex information.

**information management and control.** Capabilities to plan, organize, design, optimize, engineer, implement, operate, monitor, provision, maintain, synchronize, provide signaling and supervision, manage, control, administer, and account for information, information operations, or information systems.

**information operations. (1)** Any action or combination of actions on information. Information operations may include any or all activities for sensing, accessing, intercepting, recording, exploiting, generating, structuring, organizing, affecting, transferring/communicating, switching, routing, multiplexing, securing, processing, managing or controlling information, usually performed as part of a plan (MCTL). **(2)** Actions taken to affect adversary information and information systems while defending one’s own information and information systems (DoDD S-3600.1).

**information processing.** Capability to acquire, enter, store, retrieve, display, duplicate, transform, translate, print, publish, assure, or otherwise manipulate existing information without changing content or meaning; destroy information; or take any of a myriad of computational, logical, algorithmic, rules-based, or other machine or human intellectual action and collaboration that in real or virtual environments create new or extended content and meaning from existing information.

**information security.** Information operation capabilities to safeguard information privacy, secrecy, and integrity; control or enable access to information; authenticate and validate information content, representations, sources, and sinks; enforce nonrepudiation—in either accidental or intentional threat environments; and corrupt, obscure, extract, degrade, delete, or otherwise exploit.

**information sensors systems.** Capabilities to (a) detect any single- or multiple-faceted manifestation of properties, qualities, quantities, or other descriptive representations of material or immaterial entities; and (b) produce output signals analogous to the original manifestation sensed—in formats suitable for use in information systems. Entities may be in the form of matter (i.e., exhibiting mass properties, position and motion characteristics), information, or energy.

**information system.** The entire infrastructure, organization, personnel, and components or methods designed to conduct or accomplish specified information operation.

**information system facilities.** Virtual or physical capability to house, energize, transport, protect, and provide appropriate operating conditions and/or human habitation and life support for IS infrastructure under benign or naturally occurring or manmade conditions, or within conventional, chemical, biological, nuclear, electronic, or psychological warfare threat-driven environments.

**information visualization and human systems interface.** Capabilities for effective multidimensional interaction with knowledge, concepts, information data, or physical mechanism, including (a) representation and visualization, (b) human interface, and (c) VR representation and manipulation of space, time, entities, and views.

**information visualization and representation.** Those capabilities employed to view or make visible information by using physical techniques and processing capabilities to clearly present a data abstraction.

**information warfare.** Actions taken to achieve information superiority by affecting adversary information, information-based processes, information systems, and computer-based networks while defending one's own information, information-based processes, information systems, and computer-based networks.

**insensitive munitions.** Munitions which reliably fulfill their performance, readiness, and operational requirements on demand, but which minimize the probability of inadvertent initiation and severity or subsequent collateral damage to weapons platforms, logistics systems, and personnel when subjected to unplanned stimuli. (STANAG 4439)

**instantaneous bandwidth.** The bandwidth over which output power remains constant within 3 dB without adjustment of other operating parameters. (WA)

**instrumented range.** The specified unambiguous display range of a radar.

**integrated C3I systems.** Combinations of platforms, sensors and weapons, "software" and data-processing equipment, related communications subsystems, and user-system interfaces specifically designed for the control of U.S. armed forces and weapons systems. Command, control, communications, and intelligence systems are integrated combinations of military *command information processing, communications network, and intelligence gathering subsystems* (including surveillance, warning, and identification subsystems) that make up the U.S. C3I systems. These

combined technologies support U.S. authorities at all echelons with the integrated C3I systems that provide the timely and adequate data required to plan, direct, and control U.S. military forces and operations in the accomplishment of their missions.

**intelligent minefield.** A minefield consisting of electronically controlled munitions, which can be activated, controlled, deactivated, or neutralized to meet operational objectives. Control may be by human operators or autonomous, based on sensor data and programmed-in decision logic.

**interconnected radar sensors.** Two or more radar sensors are interconnected when they mutually exchange data in real time. (WA)

**interpolation.** The means in numerical control (NC) by which curved sections are approximated by a series of straight lines or parabolic segments.

**in the public domain.** Technology or software which has been made available without restrictions upon its further dissemination. (Copyright restrictions do not remove technology or software from being in the public domain.) (WA) See also **public domain**.

**intrinsic magnetic gradiometer.** A single magnetic field gradient sensing element and associated electronics, the output of which is a measure of magnetic field gradient. (WA) See also **magnetic gradiometers**.

**inverter.** A device that converts alternating current (AC) to direct current (DC).

**ion-assisted deposition** (also called ion beam assisted deposition.) A coating process in which any conventional coating process can be used, such as a PVD or e-beam coating, but where high-energy noble gas ions (or oxygen in the case of depositing oxides) are directed at the substrate surface to pack the coating material into a high-density composition.

**ion-beam deposition.** A coating process in which an ion beam (typically an ionized noble gas) bombards the target (of desired coating material), producing a vapor coating material. The coating process itself is similar to thermal or e-beam vapor deposition except for the source of energy to release the target material.

**ion implantation.** A surface modification coating process in which the element to be alloyed is ionized, accelerated through a potential gradient, and implanted into the surface region of the substrate. This includes processes in which ion implantation is performed simultaneously with electron beam physical vapor deposition or sputter deposition.

**ion plating.** A coating process in which a target (of desired coating material) is bombarded by one of a number of techniques to release and plate atoms or

molecules on a substrate. These techniques include DC discharge of electrons bombarding the target or a DC bias between the target and the surface of the substrate to be coated, all within an RF plasma created between them.

**isostatic presses.** Equipment capable of pressurizing a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal pressure in all directions within the cavity. (WA)

**jet propulsion.** Reaction propulsion in which the propulsion unit obtains oxygen from the air, as distinguished from rocket propulsion in which the unit carries its own oxygen-producing material. In connection with aircraft propulsion, the term refers to a gasoline or other fuel turbine jet unit that discharges hot gas through a tail pipe and a nozzle, which provides a thrust that propels the aircraft. (JP 1-02)

**K-factor (mechanics).** A standard method for expressing the surface hardness and finish of a machined gear tooth.

**kinematics.** Having to do with the motion of an object.

**knoop.** A measurement of the microhardness of a material.

**Ladar.** Laser detection and ranging systems that use a laser light for detection of speed, altitude, direction, and range.

**laser (light amplification by stimulated emission of radiation).** An assembly of components which produce both spatially and temporally coherent light that is amplified by the stimulated emission of radiation. (WA)

**laser tweezers.** Tweezers used to trap small particles/objects in a strongly focused [continuous wave (CW)] laser beam. The objects trapped in the focus of the laser beam experience a restoring force if they try to leave the high-intensity volume. An optical tweezer system is constructed by focusing light from a laser through a microscope with a high numerical aperture (e.g.,  $100 \times$  N.A. = 1.3). The tweezers can be used to move nanometer-size particles and construct a patterned array.

**latch-up free.** A device or an integrated circuit which has neither an intentional nor a nonintentional four-layer p-n-p-n structure. For example, integrated circuits properly fabricated on silicon-on-insulator (SOI) substrates would be latch-up free.

**LC<sub>50</sub>.** The LC<sub>50</sub> (lethal concentration time)<sub>50</sub> is the exposure time which will kill 50 percent of the exposed population.

**LD<sub>50</sub>.** The dose (LD is lethal dose) that will kill 50 percent of the exposed population.

**lethality.** A descriptive term used to indicate the amount of a substance that would be required to kill.

**Lidar.** Light detection and ranging systems that use a light beam in place of conventional microwave beams for atmospheric monitoring, tracking, and detection functions.

**linearity.** (Usually measured in terms of non-linearity.) The maximum deviation of the actual characteristics (average of upscale and downscale readings), positive or negative, from a straight line so positioned as to equalize and minimize the maximum deviations. (WA)

**line of sight.** Guidance by which the missile, warhead, or projectile is commanded to follow a trajectory that will cause it to intercept a target in a direction defined by a target tracker. The method requires two-way communication with the missile, warhead, or projectile either by means of an IR, RF, wire, or fiberoptic link.

**liposomes.** Self-assembled, hollow, lipid spheres generated by sonication of lipid molecules suspended in an aqueous system. The liposomes can be used to deliver drugs to persons or animals in a slow-release form.

**liquid explosive.** Explosive which is fluid at normal temperatures. (JP 1-02)

**liquid propellant. (1)** Any liquid combustible fed to the combustion chamber of a rocket engine. (JP 1-02)  
**(2)** Any liquid energetic material designed for use as a propellant charge (e.g., a gun propellant).

**local area network (LAN).** A communications network of limited geographic extent that interconnects attached equipment and may provide gateway connections to other networks.

**low explosive (LE).** An explosive that, when used in its normal manner, deflagrates or burns rather than detonates. That is, the rate of advance of the reaction zone into the unreacted material is less than the velocity of sound in the unreacted material. Low explosives include propellants, certain primer mixtures, black powder, photoflash powders, and delay compositions.

Whether an explosive reacts as a high explosive or a low explosive depends on how it is initiated and confined. For example, a double-base propellant, when initiated in the usual manner, is a low explosive. However, this material can be made to detonate if the propellant is initiated by an intense shock. Conversely, a high explosive like TNT, under certain conditions, can be ignited by flame and will burn without detonating.

**low-order burst.** The functioning of a projectile or bomb when the explosive fails to attain a high-order detonation. Usually evidenced by the breaking of the

container into a few large fragments instead of a large number of small fragments. See also **deflagration**.

**LUX genes.** The gene that codes for the protein(s) that cause fireflies and other luminescent organisms to glow.

**Mach number.** The ratio of the speed of an object to the speed of sound in the surrounding medium.

**magnetic gradiometers.** Instruments designed to detect the spatial variation of magnetic fields from sources external to the instrument. They consist of multiple “magnetometers” and associated electronics, the output of which is a measure of magnetic field gradient. (WA). See also **intrinsic magnetic gradiometer**.

**magnetic resonance imaging (MRI).** Nuclei with unpaired nucleons (neutrons or protons) possess a magnetic moment arising from the angular momentum of these “spinning” nucleons. For the unpaired protons of hydrogen in water, the proton is a charged particle with angular momentum. Placing these protons in a strong magnetic field results in the alignment of some of the protons with the external field. Angular momentum causes the protons to precess about the magnetic field. The protons precess at an explicit frequency. If an additional magnetic field B1 is then applied, a time-varying signal will occur. In a typical two-dimensional (2-D) MRI study, a gradient applied along the longitudinal (z) axis of the patient, for example, defines a “slice” that is selectively excited by the simultaneous application of a resonant radio frequency (RF) pulse. Subsequent RF pulses and gradients are employed to generate and encode the signal in the selected slice, typically yielding a  $256 \times 256$  digital array, with each element of the array representing the signal from a tissue volume (voxel) within the slice. A typical pixel of resolution is on the order of 600  $\mu\text{m}$ .

**magnetometers.** Instruments designed to detect magnetic fields from sources external to the instrument. They consist of a single magnetic field-sensing element and associated electronics, the output of which is a measure of the magnetic field. (WA)

**main storage.** The primary storage for data or instructions for rapid access by a central processing unit. It consists of the internal storage of a “digital computer” and any hierarchical extension thereto, such as cache storage or nonsequentially accessed extended storage. (WA)

**maraging steels.** A special class of high-strength, low-carbon, nickel-alloy steels, wherein the high strength (greater than 1,030 MPa) is derived from age hardening or precipitation of intermetallic compounds in the grain structure and does not involve carbon. These steels typically contain no less than 10 percent nickel; no more

than 0.03 percent carbon; and Co, Mo, Ti, and Al, as alloying elements.

**mass fraction.** The ratio of the weight of the propellant to the weight of the loaded rocket. The larger the ratio, the longer the range of the rocket.

**mass spectroscopy.** Matrix-assisted laser desorption ionization (MALDI) mass spectrometry has proved to be an important tool in synthetic and bio-polymer characterization. The molecular sizes that can be sequenced by this technique are limited at this time, but the method has demonstrated utility for determining mutation sites in DNA fragments.

**matrix.** A substantially continuous phase that fills the space between particles, whiskers, or fibers. (WA)

**measurement uncertainty.** The characteristic parameter that specifies in what range around the output value the correct value of the measurable variable lies with a confidence level of 95 percent. It includes the uncorrected systematic deviations, the uncorrected backlash, and the random deviations. (Ref.: VDI/VDE 2617.) (WA)

**mechanical alloying.** An alloying process resulting from the bonding, fracturing, and rebonding of elemental and master alloy powders by mechanical impact. Nonmetallic particles may be incorporated in the alloy by the addition of the appropriate powders. (WA)

**mechanically controlled variable sequence manipulation mechanisms.** Automated moving devices operating according to mechanically fixed programmed motions. The program is mechanically limited by fixed, but adjustable, stops such as pins or cams. The sequence of motions and the selection of paths or angles are variable within the fixed program pattern. Variations or modifications of the program pattern (e.g., changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations.

**median lethal dosage (vapor/aerosol, LC<sub>50</sub>).** The amount of agent (vapor, aerosol) expected to kill 50 percent of exposed, unprotected people.

**median lethal dose (liquid, LD<sub>50</sub>).** The single dose of a substance that causes death of 50 percent of a population from exposure to the substance by any route other than inhalation.

**melt extraction.** A process to “solidify rapidly” and extract a ribbon-like alloy product by the insertion of a short segment of a rotating chilled block into a bath of a molten alloy. (WA)

**melt spinning.** A process to “solidify rapidly” a molten metal stream impinging upon a rotating chilled block, forming a flake, ribbon, or rod-like product. (WA)

**micro.** A unit of measure that is equal to  $1 \times 10^{-6}$ .

**micro air vehicles.** Unmanned air vehicles that are extremely small.

**microcomputer microcircuit.** A “monolithic integrated circuit” or “multichip integrated circuit” containing an arithmetic logic unit capable of executing general purpose instructions from an internal storage on data contained in the internal storage. (The internal storage may be augmented by an external storage.) (WA)

**microelectromechanical systems (MEMS).** (1) Ultra-small devices that can record information or direct and control movement on a molecular basis. The light-detecting and transducing elements can be biological molecules, such as bacterial rhodopsin or a biomimetic such as phthalocyanine. The molecular motors can be biopolymers, such as dynein, kinesin, and actin. (2) A highly miniaturized device or an array of devices combining electrical and mechanical components that is fabricated using integrated circuit (IC) batch-processing techniques.

**micromachines.** Machines that are capable of performing extremely small (millimeter range) function elements of complicated tasks.

**micrometrology.** The measurement of parameters on the micrometer scale.

**microprogram.** A sequence of elementary instructions maintained in a special storage, the execution of which is initiated by the introduction of its reference instruction into an instruction register. (WA)

**militarily critical technologies.** Technologies, the technical performance parameters of which are at or above the minimum level necessary to ensure continuing superior performance of U.S. military systems.

**military explosives.** Solid, liquid, or gaseous substances or mixtures of substances which are required to detonate in their application as primary, booster, or main charge in warhead, demolition, and other military applications. (WA)

**military propellants.** Solid, liquid, or gaseous substances or mixtures of substances used for propelling projectiles and missiles or to generate gases for powering auxiliary devices for embargoed military equipment and which, when ignited, burn or deflagrate to produce quantities of gas capable of performing work; but in their application these quantities are required not to undergo a deflagration-to-detonation transition. (WA)

**military pyrotechnics.** Mixtures of solid or liquid fuels and oxidizers which, when ignited, undergo an energetic chemical reaction at a controlled rate intended to produce specific time delays, or quantities of heat,

noise, smoke, visible light, or infrared radiation. Pyrotechnics are a subclass of pyrotechnics which contain no oxidizers but ignite spontaneously on contact with air. (WA)

**milli.** A unit of measure that is equal to  $1 \times 10^{-3}$ .

**mine.** An encased explosive or chemical charge designed to be positioned so that it detonates when its target touches or moves near it or when touched off by remote control. General types are land and underwater.

**minimum smoke.** A descriptive term used for propellants that produce the least amount of smoke under specified conditions. The term is difficult to quantify, but AGARD identifies these as class AA propellants.

**mirrors.** Reflective optical elements that have a smooth flat plane or curved highly polished surface for reflecting radiation. The actual reflecting surface is usually a thin coating of silver or aluminum with a series of multilayer dielectrics to enhance the reflectivity of particular frequencies.

**missile control.** The process of steering a missile, while stabilizing it against disturbances such as wind gusts or blast, by the operation of aerodynamic surfaces, air or jet vanes, gas jets, or attitude control of rocket motors. Control subsystems respond to guidance signals to correct the attitude and position of a missile and to activate power sources, servomechanisms, and other components.

**Missile Technology Control Regime (MTCR).** A voluntary agreement among countries that aims to restrict the proliferation of missiles, unmanned air vehicles (UAVs), and related technology for those systems capable of carrying a 500-kg payload at least 300 km, as well as systems intended for the delivery of weapons of mass destruction (WMD). Missiles include ballistic missiles, space-launch vehicles, and sounding rockets. UAVs include cruise missiles, drones, UAVs, and remotely piloted vehicles (RPVs). The MTCR was formed in 1987 by the G-7 countries and its membership has expanded to 33 nations).

**modeling.** Mathematical, statistical, or algorithmic representation of aspects of the real world which can be used to determine characteristics and parameters of interest.

**modulator.** A functional unit that converts a signal into a modulated signal suitable for transmission. Contrast with demodulator. (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM, 1981).

**molecular evolution database.** A database that identifies the molecular sequence of genes and the proteins they code to allow determination of the changes in

protein structure in different species. This can be used to develop models that predict which changes in amino acid sequence will increase or decrease the functional activity of the proteins.

**molecular imprinting.** The production of a topographically defined space in a hydrogel or elastomer surface that conforms to the specific shape and electron density of a molecule. The space is generally a convexity. The molecule may be a toxin, C, or B agent. The utility of these surfaces is in vaccine, sensor, or combinatorial chemistry production. The dimensions of the space approximate  $20 \times 100$  angstroms and a depth of 10 angstroms.

**molecular probes.** Low molecular weight compounds that reveal conformation of proteins or nucleic acid by changing light absorbing/emitting properties. Examples include dyes that bind double-stranded DNA and change light-absorbing properties. Some probes fluoresce in the presence of calcium or other divalent cations and therefore can be used to measure cellular depolarization activity.

**molecular wires.** Optical or electrical conductive materials that have dimensions on the nanometer scale in width and can approach millimeter lengths. The materials are usually organic polymers or doped organic polymers.

**monoclonal. (1)** Antibodies. **(2)** Proteins which bind to one antigenic site and are produced by a single clone of cells.

**monoclonal antibodies.** In the early 1970's, Kohler and Milstein developed a method to produce antibodies against a single antigenic epitope. An epitope is that region of a molecule that initiates production of a single antibody species by the body. The dimensions of an epitope approximate a surface area  $50 \times 50$  angstroms, which is equivalent to a six amino acid sequence in a protein or a six saccharide unit in a polysaccharide. Monoclonal antibodies may be produced in gram quantities in a highly reproducible manner with quality control. They are therefore suited for industrial production and can be components of sensors and diagnostics. The medical, pharmaceutical, cosmetic, food, and environmental industries use monoclonal antibodies.

**monolithic integrated circuit.** A combination of passive or active "circuit elements" or both which are formed by means of diffusion processes, implantation processes, or deposition processes in or on a single semiconducting piece of material, a so-called "chip," and can be considered as indivisibly associated *and* perform the function(s) of a circuit. (WA)

**motion control board.** An electronic assembly of a number of connected electronic components (i.e., "cir-

cuit elements," "discrete components," integrated circuits, etc.), specially designed to provide a computer system with the capability to coordinate simultaneously the motion of axes of machine tools for "contouring control."

**multichip integrated circuit.** Two or more "monolithic integrated circuits" bonded to a common "substrate." (WA)

**multi-data-stream processing.** The "Microprogram" or equipment architecture technique which permits simultaneous processing of two or more data sequences under the control of one or more instruction sequences by means such as:

- Single instruction multiple data (SIMD) architectures such as vector or array processors;
- Multiple single instruction multiple data (MSIMD) architectures;
- Multiple instruction multiple data architectures, including those which are tightly coupled, closely coupled, or loosely coupled; or
- Structured arrays of processing elements, including systolic arrays. (WA)

**multilevel security.** A class of system containing information with different sensitivities that simultaneously permits access by users with different security clearances and needs-to-know, but prevents users from obtaining access to information for which they lack authorization. (WA)

**multimodal display systems.** Displays that use several sense modalities to present information in an integrated manner to improve comprehension by the user. Such displays incorporate visual icons and auditory signals to encode changes in data presentations. Examples include anesthetic monitors that incorporate visual and auditory signals to represent changes in heart rate, blood pressure, respiration, and blood oxygen levels.

**multiple transverse mode.** Modes of a laser that are normal to the direction of propagation. Any laser, the average divergence of which is larger than that allowed for a "single transverse mode" laser, will be considered to be multimode.

**multispectral imaging sensors** (multispectral imagers). Sensors capable of simultaneous or serial acquisition of imaging data from two or more discrete spectral bands. Sensors having more than 20 discrete spectral bands are sometimes referred to as hyperspectral imaging sensors (hyperspectral imagers). (WA)

**multivariate.** Involving a number of independent mathematical variables.

**munition.** A complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. Certain suitably modified munitions can be used for training, ceremonial, or nonoperational purposes. Also called ammunition. [Note: In common usage, “munitions” (plural) can be military weapons, ammunition, and equipment.] (DoD, NATO). See also **explosive ordnance**.

**munition response.** The resulting behavior (such as blast, overpressure, fragment spray, and heat) produced by a munition as a result of stimuli generated by a threat or combination of threats.

**mustard (HD).** A vesicant chemical warfare agent which has been used extensively in warfare. Creates destruction of epidermis, eye and pulmonary injury, and, in high doses, bone-marrow depression.

**nano.** A unit of measure that is equal to  $1 \times 10^{-9}$ .

**nanoelectromechanical systems (NEMS).** A term used to describe an even smaller device than microelectromechanical (MEMS). Where “micro” is a Greek term for small and “nano” is a Greek term for dwarf.

**nanofabrication.** Fabrication or production of systems on the nanometer scale. Most often refers to electronic circuits comprising electrically conductive polymers or photon-conducting polymers.

**nanophase.** A form of matter in which small clusters of atoms form the building blocks of a larger structure. These structures differ from those of naturally occurring crystals, in which individual atoms arrange themselves into a lattice.

**nanotechnology.** The technology employed in the development of techniques for the manufacture of nanometer-size items.

**nanotesla (nT).** The unit of magnetic induction generally used for geophysical work.

**near-field optical scanning microscopy (NSOM).** See **atomic force microscopy (AFM)**.

**nerve agent.** Extremely toxic compounds that produce convulsions and rapid death by inactivating an enzyme (acetylcholinesterase) essential for the normal transmission of nerve impulses.

**network access controller.** A physical interface to a distributed switching network. It uses a common medium which operates throughout at the same digital transfer rate using arbitration (e.g., token or carrier sense) for transmission. Independently from any other, it selects data packets or data groups (e.g., IEEE 802) addressed to it. It is an assembly that can be integrated

into computer or telecommunications equipment to provide communications access. (WA)

**neural computer.** A computational device designed or modified to mimic the behavior of a neuron or a collection of neurons, i.e., a computational device which is distinguished by its hardware capability to modulate the weights and numbers of the interconnections of a multiplicity of computational components based on previous data. (WA)

**neural nets.** Originally referred to organized sets of neurons in the central nervous system. These nets use parallel information processing. The phrase now includes computer nodes that process information in a manner similar to organized clusters of nerve cells.

**neural networks.** Computational devices designed to emulate in a simplistic manner the computational processes of the brain by utilizing a variety of simple computational devices (artificial neurons) arranged in large networks that can be trained.

**neurotransmitters.** Chemical substances that transmit nerve impulses across the synapses (junctions) between certain types of nerve cells.

**nitrogen mustard.** A vesicant which attacks deoxyribonucleic acid (DNA). Is also used as an antineoplastic agent (classed as an alkylating agent). Several were developed as CW agents. Also produces pulmonary injury and bone-marrow depression.

**noble metal modified aluminide.** Nickel or titanium aluminide modified with noble metals such as platinum or rhodium.

**noise level.** An electrical signal given in terms of power spectral density. The relation between “noise level” expressed in peak-to-peak is given by  $S_{pp}^2 = 8N_o(f_2 - f_1)$ , where  $S_{pp}$  is the peak-to-peak value of the signal (e.g., nanoteslas),  $N_o$  is the power spectral density [e.g., (nanotesla)<sup>2</sup>/Hz], and  $(f_2 - f_1)$  defines the bandwidth of interest. (WA)

**nondestructive evaluation or test.** (NDE/ NDT). Methods of measuring materials, parts, structures, or systems without altering the characteristics of the test object(s).

**nonpersistent agent.** A chemical agent that disperses or vaporizes rapidly after release and presents an immediate short duration hazard. These agents are generally released as aerosols, gases, vapors, liquids, or solids.

**nonphysical transport communications systems.** Transmission facilities—that is, the medium (free space, the atmosphere, copper or fiber-optic cable)—and electronic equipment located at nodes along the medium.

**nonservo-controlled variable sequence manipulation mechanisms.** Automated moving devices operating according to mechanically fixed programmed motions. The program is variable but the sequence proceeds only by the binary signal from mechanically fixed electrical binary devices or adjustable stops.

**nuclear reactor.** A device containing fissionable material in sufficient quantity arranged in a manner to sustain a controlled nuclear reaction.

**nuclear yields.** The energy released in the detonation of a nuclear weapon, measured in terms of kilotons or megatons of trinitrotoluene required to produce the same energy release. Yields are categorized as follows: very low—less than 1 kiloton; low—1 kiloton to 10 kilotons; medium—over 10 kilotons to 50 kilotons; high—over 50 kilotons to 500 kilotons; very high—over 500 kilotons. (JP 1-02)

**numerical control (NC).** The automatic control of a process performed by a device that makes use of numeric data usually introduced as the operation is in progress. (Reference: ISO 2382.) (WA)

**object code (or object language).** The machine-readable code. See also **source code**.

**obscurants.** Any gas, liquid, or solid particle, either man-made or natural, suspended in the atmosphere that affects any part of the electromagnetic spectrum by scattering, absorption, radiance, reflection, or refraction.

**observable.** The parameters (such as distance, speed, or shape) of a vehicle that can be seen optically, electronically, magnetically, acoustically, or thermally.

**one-point safe.** A nuclear weapon is one-point safe if there is a probability of less than one part in a million of a nuclear energy release greater than or equal to 4 pounds TNT equivalent when high explosives are detonated at the single point most likely to produce nuclear yield.

**operate autonomously.** Refers to the ability of a vehicle to move between two or more known locations without the need for human intervention.

**operate through.** The ability of an electronic system to function without major degradation during transient nuclear events.

**operation decoder.** A device that selects one or more control channels according to the operation part of a machine instruction. (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM, 1981)

**optical amplification.** An amplification technique that introduces a gain to optical signals that have been generated by a separate optical source without the need

for conversion to electrical signals (i.e., using semiconductor optical amplifiers or optical fiber luminescent amplifiers). (WA) This technique is used in optical communications as well as other optical and electro-optical systems.

**optical computer.** A computer designed or modified to use light to represent data and with computational logic elements based on directly coupled optical devices. (WA)

**optical integrated circuit.** A “monolithic integrated circuit” or a “hybrid integrated circuit” containing one or more parts designed to function as a photosensor or photoemitter or to perform (an) optical or (an) electro-optical function(s). (WA)

**optical switching.** The routing of or switching of signals in optical form without conversion to electrical signals. (WA)

**optoelectronic.** A device that responds to optical power, emits or modifies optical radiation, or utilizes optical radiation for its internal operation and functions as an electrical-to-optical or optical-to-electrical transducer. See also **electro-optics**.

**organic composite.** A class of composite materials consisting of an organic thermoset or thermoplastic resin matrix reinforced with higher strength organic or inorganic materials in the form of whiskers, chopped fibers, and continuous fiber tows in any number of random or precisely controlled architectures.

**organophosphorus.** Containing phosphorus and carbon.

**overall current density.** The total number of ampere-turns in the coil (i.e., the sum of the number of turns multiplied by the maximum current carried by each turn) divided by the total cross section of the coil (comprising the superconducting filaments, the metallic matrix in which the superconducting filaments are embedded, the encapsulating material, any cooling channels, etc.). (WA)

**oximetry.** Measurement of the vascular system’s oxygen carrying capacity.

**pack cementation.** Any surface modification coating or overlay coating process wherein a substrate is immersed in a powder mixture (a pack) that consists of:

1. The metallic powders that are to be deposited (usually aluminum, chromium, silicon, or combinations thereof);
2. An activator (normally a halide salt); *and*
3. An inert powder, most frequently alumina.

The substrate and powder mixture are contained within a retort which is heated to between 1,030 K (757 °C) to 1,375 K (1,102 °C) for sufficient time to deposit the coating. (WA)

**part.** Any single unassembled element of a major or a minor component, accessory, or attachment which is not normally subject to disassembly without the destruction or the impairment of design use. (Examples: rivets, wire, bolts, etc.) (ITAR, Sec. 121.8)

**passive armor (ordnance).** A protective device designed to absorb or deflect the energy from an antiarmor warhead.

**passive homing (guidance).** A mode of guidance in which the direction is obtained from signals emitted by the target without the necessity for illuminating or interrogating the target with an external signal.

**passive system (sensors).** A sensor system that does not use emitted energy, but relies upon signals emitted by its intended target. Forms of passive sensors common in military use include acoustic, gravimetric, seismic, magnetic, radio frequency, microwave and millimeter wave, and optical (including IR, visible, and UV). Such sensors are used for target detection, identification, and localization to support a wide range of military functions including surveillance, fire control, and weapon fuzing.

**pathogen.** Any agent capable of causing disease, although usually applied to living agents.

**pathogenicity islands (PAIs).** Polynucleotide genetic sequences common to biological agents that allow B agents to be effective pathogens. An excellent review is presented by E. Strauss and S. Falkow, "Microbial Pathogenesis: Genomics and Beyond," *Science*, 276, 1997, 707–712.

**peak power.** Energy per pulse in joules divided by the pulse duration in seconds. (WA)

**percutaneous.** Effected or performed through the skin.

**persistent agent.** A chemical agent that, when released, remains able to cause casualties for more than 24 hours to several days or weeks. (JP 1-02)

**photonics.** The technology of generating and harnessing light and other forms of radiant energy whose quantum unit is the photon. The science includes light emission, transmission, deflection, amplification, and detection by optical components and instruments, lasers and other light sources, fiber optics, electro-optical instrumentation, related hardware and electronics, and sophisticated systems. The range of applications of photonics extends from energy generation to detection to communications and information processing.

**photosystems.** The photon-detecting properties of a system.

**picnite.** Nitroguanidine.

**piezoelectric.** Having the ability to generate a voltage when mechanical force is applied, as in piezoelectric crystal.

**plasma spraying.** Any overlay coating process wherein a gun (spray torch), which produces and controls a plasma, accepts powder or wire coating materials, melts them, and propels them towards a substrate, whereon an integrally bonded coating is formed. (WA)

**polable.** The property by which a polymeric material orients in three-dimensional space as an electrical potential is applied to the field.

**polyclonal antibodies.** A mixture of proteins which binds to the specific antigen and is produced by more than one clone of cells.

**positime.** Linked position and time data provided by an information system (e.g., GPS, NDGPS, LORAN, WAAS and LAAS).

**positioning accuracy.** A term to denote the difference between the true displacement of a machine tool and that recorded by the machine measurement system.

**power management (electrical systems).** Technique of regulating the generation and use of electrical power for maximum system efficiency for the purpose of enhancing operational performance or extending the effective operating life of the system.

**power management (sensors/low observables).** The technique of controlling the transmitted power of a system so that received power is always at the minimum necessary to ensure the effective operation of the system.

**precision-guided munition.** A munition equipped with a sensor that interacts with its aerodynamic control surfaces and falls into one of the following categories: "guided," "smart," or "brilliant."

**precursor.** A specialty chemical compound from which another product such as explosives, chemical agents, or high-strength/high-modulus ceramic or carbon fibers are derived.

**primary battery.** Primary batteries are those that cannot be recycled and are discarded once their charge has been depleted. Because of the inherent self-discharge caused by the chemical activity in a battery, a special subclass of primary batteries exist. See also **thermal battery** and **reserve battery**.

**primary smoke.** The solid particulates from the combustion of a fuel, pyrotechnic, or propellant. Metal and

elemental fuels and other additives in energetic materials or by themselves contribute significantly to primary smoke. See also **secondary smoke**.

**principal element (export control).** An element is a “principal element” when its replacement value is more than 35 percent of the total value of the system of which it is an element. Element value is the price paid for the element by the manufacturer of the system, or by the system integrator. Total value is the normal international selling price to unrelated parties at the point of manufacture or consolidation of shipment. (WA)

**producibility.** The elements of a design by which a product or a commodity, while meeting all of its performance objectives within the design constraints, may be produced in the shortest total time, at the lowest cost, with the most readily available materials, using the most advantageous processes and assembly methods. (U.S. Army, AMC definition.)

**production.** All production stages, such as product engineering, manufacture, integration, assembly (mounting), inspection, testing, and quality assurance. (WA)

**progressivity.** The rate of increase of the burning rate or of the surface area of burning propellant. See also **propellant grain**.

**proof test.** The on-line or off-line production screen testing that dynamically applies a prescribed tensile stress over a 0.5 to 3 m length of fiber at a running rate of 2 to 5 m/s while passing between capstans approximately 15 cm in diameter. The ambient temperature is a nominal 293 K, and relative humidity is 40 percent.

**propellant.** That source which provides the energy required for propelling a projectile. Specifically, an explosive charge for propelling a projectile; also a fuel, either solid or liquid, for propelling a rocket or missile.

**propellant grain.** A single piece of propellant, the dimensions of which may vary from a few millimeters to several meters, and known as the configuration for single grains or the granulation for charges consisting of more than one grain. Configurations are changed to vary the exposed surface of grains and thus vary the burning surface. A grain that maintains a constant burning surface has a neutral configuration; a grain with a surface area or burning rate that increases has a progressive configuration; a grain with a burning surface that decreases has a degressive configuration.

**propellant powder.** A low explosive of fine granulation that, by burning, produces gases at a controlled rate, thus providing energy for propelling a projectile. Restricted to small arms propellants, for which the grain size is small. In larger grain form it is called simply “propellant.”

**prophylaxis.** Measures designed to preserve health and prevent the spread of disease, that is, protective, preservative treatment.

**protocols.** Communication instruction sets which include rules governing how data is structured into packets and sent from one machine to another.

**proximity fuze.** A fuze wherein primary initiation occurs by remotely sensing the presence, distance, and/or direction of a target or its associated environment by means of a signal generated by the fuze or emitted by the target or by detecting a disturbance of a natural field surrounding the target. (DoD, NATO). See also **fuze**.

**pseudolite.** Ground-based satellite usually used for tracking and test ranges.

**public domain.** Information which is published and which is generally accessible or available to the public:

1. Through sales at newsstands and bookstores;
2. Through subscriptions which are available without restriction to any individual who desires to obtain or purchase the published information;
3. Through second class mailing privileges granted by the U.S. Government;
4. At libraries open to the public or from which the public can obtain documents;
5. Through patents available at any patent office;
6. Through unlimited distribution at a conference, meeting, seminar, trade show or exhibition, generally accessible to the public, in the United States;
7. Through public release (i.e., unlimited distribution) in any form (e.g., not necessarily in published form) after approval by the cognizant U.S. Government department or agency;
8. Through fundamental research in sciences and engineering at accredited institutions of higher learning in the United States where the resulting information is ordinarily published and shared broadly in the scientific community. Fundamental research is defined to mean basic and applied research in science and engineering where the resulting information is ordinarily published and shared broadly within the scientific community, as distinguished from research, the results of which are restricted for proprietary reasons or specific U.S. Government access and dissemination controls. University research will not be considered fundamental research if:

- a. The university or its researchers accept other restrictions on publication of scientific and technical information resulting from the project or activity, or
- b. The research is funded by the U.S. Government and specific access and dissemination controls protecting information resulting from the research are applicable. (ITAR Sec 120.11.)

See also **in the public domain**.

**pulse compression.** The coding and processing of a radar signal pulse of long time duration to one of short duration to increase range resolution while maintaining the benefits of high pulse energy. (WA)

**pulse duration.** The time interval between the first and last instants at which the instantaneous amplitude reaches a stated fraction of a peak amplitude.

**pulse width.** The time interval between the half power points (relative to peak instantaneous power) on the leading and trailing edges of the pulse.

**pyrophorics.** See **military pyrotechnics**.

**pyrotechnic.** A mixture of chemicals which, when ignited, is capable of reacting exothermically to produce light, heat, smoke, sound, or gas, and may also be used to introduce a delay into an explosive train because of its known burning time. The term excludes propellants and explosives. (JP 1-02)

**Q-switched laser.** A “laser” in which the energy is stored in the population inversion or in the optical resonator and subsequently emitted in a pulse. (WA) The pulsed output occurs when the cavity resonator Q (the figure of merit of a resonator cavity) is kept very low and then instantaneously increased to allow the stored energy to exit the cavity quickly.

**radar frequency agility.** Any technique which changes, in a pseudo-random sequence, the carrier frequency of a pulsed-radar transmitter between pulses or between groups of pulses by an amount equal to or larger than the pulse bandwidth. (WA)

**radar spread spectrum.** Any modulation technique for spreading energy origination from a signal with a relatively narrow frequency band over a much wider band of frequencies using random or pseudorandom coding. (WA)

**real-time.** (1) In solving a problem, a speed sufficient to give an answer within the actual time the problem must be solved; (2) pertaining to the actual time during which a physical process occurs; and (3) pertaining to the performance of a computation during the actual time that the related physical process occurs so that results of

the computation can be used in guiding the physical process.

**real-time bandwidth.** For “dynamic signal analyzers,” the widest frequency range the analyzer can output to display or mass storage without causing any discontinuity in the analysis of the input data. For analyzers with more than one channel, the channel configuration yielding the widest “real-time bandwidth” shall be used to make the calculation. (WA)

**real-time processing.** The processing of data by a computer system providing a required level of service, as a function of available resources, within a guaranteed response time, regardless of the load of the system, when stimulated by an external event. (WA)

**real-time spectrum analyzers.** See **dynamic signal analyzers**.

**receptors.** Biological macromolecular structures capable of binding ligands, the binding of which affects physiological functions. These receptors recognize and bind hormones, neurotransmitters, and other endogenous compounds with high affinity and specificity.

**recombinant DNA (rDNA).** DNA prepared in the laboratory by splitting and splicing DNA from different species, with the resulting recombinant DNA having different properties than the original.

**reduced smoke.** A descriptor for propellants that have been tailored to produce less smoke than standard formulations of aluminum and ammonium perchlorate. They may be classified by AGARD as either class AC or BC. See also **smoky**.

**repeatability.** Closeness of agreement of repeated position movements to the same indicated location and under the same conditions.

**required (export control).** As applied to “technology,” refers to only that portion of “technology” which is peculiarly responsible for achieving or exceeding the embargoed performance levels, characteristics, or functions. Such “required” “technology” may be shared by different products. (WA)

**reserve battery.** A subclass of primary batteries that separates the active elements until power is required. These batteries must be able to tolerate extreme shock accelerations, up through 20,000 Gs, for various munitions.

**resistive heating PVD.** See **thermal evaporation-physical vapor deposition (TE-PVD)**.

**resolution.** The least increment of a measuring device; on digital instruments, the least significant bit. (Reference: ANSI B-89.1.12.) (WA)

**riot control agents.** Substances which in low concentrations produce temporarily irritating or disabling physical effects that disappear within minutes of removal from exposure. There is minimal risk of permanent injury, and medical treatment is rarely required. (WA)

**robot.** A manipulation mechanism, which may be of the continuous path or of the point-to-point variety, may use sensors, and has all the following characteristics:

- Is multifunctional;
- Is capable of positioning or orienting material, parts, tools, or special devices through variable movements in three-dimensional space;
- Incorporates three or more closed- or open-loop servo devices which may include stepping motors; *and*
- Has “user-accessible programmability” by means of the teach/playback method or by means of an electronic computer which may be a programmable logic controller, i.e., without mechanical intervention.

N.B. The above definition does not include the following devices:

- Manipulation mechanisms which are only manually/teleoperator controllable.
- Fixed sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The program is mechanically limited by fixed stops, such as pins or cams. The sequence of motions and the selection of paths or angles are not variable or changeable by mechanical, electronic, or electrical means.
- Mechanically controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The program is mechanically limited by fixed but adjustable stops, such as pins or cams. The sequence of motions and the selection of paths or angles are variable within the fixed program pattern. Variations or modifications of the program pattern (e.g., changes of pins or exchanges of cams) in one or more motion axes are accomplished only through mechanical operations.
- Non-servo-controlled variable sequence manipulation mechanisms which are automated moving devices, operating according to mechanically fixed programmed motions. The program is variable but the sequence proceeds only by the binary signal

from mechanically fixed electrical binary devices or adjustable stops.

- Stacker cranes defined as Cartesian coordinate manipulator systems manufactured as an integral part of a vertical array of storage bins and designed to access the contents of those bins for storage or retrieval. (WA)

**rocket motor.** A non-airbreathing reaction propulsion device consisting of a thrust or combustion change in which formulations of solid fuels, oxidizers, and additives are burned and expanded through an exhaust nozzle.

**rogue nations.** While there is no standard definition, rogue nations are generally those that defy the civilized world and operate outside of international norm, especially with respect to the development of weapons of mass destruction, drugs, and counterfeiting.

**rogue states.** See rogue nations.

**rotary atomization.** A process to reduce a stream or pool of molten metal droplets to a diameter of 500  $\mu\text{m}$  or less by centrifugal force. (WA)

**router.** A device which connects a LAN to one or more other LANs and then to one or more WAN(s).

**run out (out-of-true running).** Radial displacement in one revolution of the main spindle measured in a plane perpendicular to the spindle axis at a point on the external or internal revolving surface to be tested. (Reference: ISO 230/1-1986, paragraph 5.61). (WA)

**sarin.** A nerve agent of the organophosphate group which inhibits acetylcholinesterase.

**scalability (engineering).** Questions whether the physics, and therefore the electromechanical assembly, behaves the same at varying dimensions, i.e., does MEMS scale similarly to NEMS (nanoelectromechanical systems) or PEMS (picoelectromechanical systems)?

**scale factor (gyro or accelerometer).** The ratio of change in output to a change in the input intended to be measured. Scale factor is generally evaluated as the slope of the straight line that can be fitted by the method of least squares to input-output data obtained by varying the input cyclically over the input range. (WA)

**scanning spectrum analyzer.** A scanning device used to cyclically tune through a given frequency range to determine the amplitude-frequency distribution of the signals present. See also **signal analyzer**.

**secondary battery.** A rechargeable battery which is more expensive and has lower power and a shorter shelf life than primary batteries.

**secondary smoke.** Smoke that results from the interaction of propellant or pyrotechnics, which later form droplets that condense on submicron atmospheric particles. Low temperatures, high humidity, and acid vapors, such as the HCl combustion products of ammonium perchlorate, all contribute to secondary smoke formation.

**secret parameter.** A constant or key kept from the knowledge of others or shared only within a group.

**seeker.** A device that orients a munition's sensor to survey, acquire, lock on, and track a target.

**self-assembling membranes (SAMs).** SAMs are mono- or bimolecular leaflets that form monolayers on a surface matrix. The SAMs are most frequently comprised of lipids that self assemble either from sonication of the lipids in an aqueous medium or by floating the lipids on an aqueous surface using a Langmuir Blodgett apparatus. These kinds of SAMs have application in the production of sensors.

**self-destroying fuze.** A fuze designed to burst a projectile before the end of its flight. (DoD, NATO). See also **fuze**.

**self-discharge.** The slow removal of a primary and secondary battery's charge due to the inherent chemical activity.

**semantics.** (1) The relationship of characters or groups of characters to their meanings, independent of the manner of their interpretation and use. (ISO) (2) The relationships between symbols and their meanings. (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM 1981)

**semi-active.** Missile or warhead guidance in which the target is illuminated by an auxiliary emitter (e.g., a laser or radar beam) and the missile or warhead homes in on the signal (reflection) from the target.

**semi-permeable.** Permeable to some (usually small) molecules but barring the passage of others (usually larger).

**sensor.** Any equipment which detects and may indicate and/or record objects and activities by means of energy or particles emitted, reflected, or modified by objects.

**sensor-fuzed munition.** A munition in which the lethal mechanism of the warhead is initiated or deployed to achieve optimum effectiveness based on commands derived from an on-board target detection device. Target detection sensors may be active or passive, and may incorporate features for target localization or aim-point selection.

**sentient (or correlated).** A type of "brilliant" munition that is aware of itself and its surroundings; for example,

a brilliant munition that responds to its environment, or communicates with others among the same payload or salvo to seek out the targets and maximize interception.

**settling time.** The time required for the output to come within 1/2 bit of the final value when switching between any two levels of the converter. (WA)

**shaped-charge.** A type of explosively driven penetrator characterized by a relatively deep initial liner shape which forms a narrow hypervelocity jet. The ballistic properties of the jet are such that the warhead must be initiated within a few warhead diameters of the intended target to be effective.

**shared aperture optical elements.** Optics that reflect a portion of the impinging radiation in a manner similar to conventional beam splitters and composed of buried lenses or buried "gratings."

**shearography.** Electronic shearography is a noncontact laser interferometry NDE method which provides full-field fringe pattern images representing changes in the surface slope of the test article due to some form of excitation. Flaws in composite or layered materials manifest themselves as anomalies in the surface slope fringe pattern.

**shuttered fuze.** A fuze in which inadvertent initiation of the detonator will not initiate either the booster or the burst charge. (DoD, NATO). See also **fuze**.

**signal analyzer.** Apparatus capable of measuring and displaying basic properties of the signal-frequency components of multi-frequency signals. (WA)

**signal analyzers (dynamic).** See **dynamic signal analyzers**.

**signal processing.** The processing of externally derived information-bearing signals by algorithms such as time compression, filtering, extraction, selection, correlation, convolutions, or transformations between domains (e.g., fast Fourier transform or Walsh transform). (WA)

**signature.** Any or all of the properties of an object that may be used for the detection, identification, or engagement of the object or its origin.

**significant military equipment.** Articles for which special export controls are warranted because of their capacity for substantial military utility or capability. (ITAR, Sec. 120.7)

**simulation.** Capabilities of taking on the appearance, form, sound, or other characteristics of some aspect of the real world, most often associated with a time progression when implemented.

**single-transverse mode.** A laser mode that has a field vector normal to the direction of propagation. A single-transverse mode laser has only one mode lasing at any

time. Any laser with an average beam divergence measured on any two orthogonal axes equal to or less than 3.45 times the wavelength, divided by the aperture diameter along that axis for the angle containing 84 percent of the beam energy will be considered a single transverse mode laser.

**slurry deposition.** A surface modification coating or overlay coating process wherein a metallic or ceramic powder with an organic binder is suspended in a liquid and is applied to a substrate by either spraying, dipping, or painting, followed by air or oven drying and heat treatment to obtain the desired coating. (WA)

**smart materials.** Materials that have the capability to respond to an external stimulus by changing, in a controlled manner according to prescribed functional relationships or control algorithms, their energy-dissipation properties and geometric configuration, or by changing their stiffness.

**smart munition.** A “many-on-many” munition with target selection capability that does not require an operator in the loop.

**smoke.** A deliberate obscurant or colored signal, or the inadvertent effluent from the combustion of a pyrotechnic or propellant, any of which is made visible by light scattered or absorbed by condensed or liquid. A component of the signature of a gun or missile propellant.

**smokeless.** A nitrocellulose-based gun or rocket propellant as distinct from a relatively “smoky” black powder explosive. The term originally (late 19th century) applied to a single-base NC propellant, but later also became applied to double- or triple-based propellants to which additives had been incorporated to reduce smoke.

**smoky.** A particular term used to describe rocket and missile propellants with high aluminum and ammonium perchlorate contents. An AGARD class CC composition.

**software.** (1) Programs, data bases, and associated documentation available on human and/or machine-readable media such as paper, magnetic tapes, disks, or embedded firmware that operate computers. (MCTL) (2) A collection of one or more “programs” or “microprograms” fixed in any tangible medium of expression. (WA) (3) A set of computer programs, procedures, and associated documentation concerned with the operation of a data processing systems, e.g., compilers, library routines, manuals, and circuit diagrams. (Joint Pub 1.02.) (4) Includes, but is not limited to, the system functional design, logic flow, algorithms, application programs, operating systems and support software for

design implementation, test operation, diagnosis, and repair. (ITAR, Sec. 121.8(f))

**software documentation.** Information in human-readable form, including computer source code listings and printouts, which documents the design or details of the computer software, explains the capabilities of the software, or provides operating instructions for using the software to obtain the desired results from a computer.

**software support.** Resources such as people, facilities, documentation, information, and instrumentation to operate, maintain, or produce software products.

**solidify rapidly.** Solidification of molten material at cooling rates exceeding 1,000 K/sec. (WA)

**solids loading.** The percentage of particulate matter in the total weight/volume of a propellant composition or grain. The solids loading attainable for a given fuel-oxidizer particulate composition depends on the binder and additives used to form a grain. Missile propellants are commonly rated in terms of a weight percentage; gun propellants, in terms of a volume percentage.

**soman.** A nerve agent member of the organophosphate group, it inhibits acetylcholinesterase and is used as a chemical warfare agent.

**source code.** (1) Source code, a subset of computer software documentation, is a set of symbolic computer instructions that is written in a high-level/human-readable language that cannot be directly executed by the computer without first being translated into object code. (MCTL) (2) A convenient expression of one or more processes which may be turned by a programming system into equipment-executable form (“object code”) or object language. (WA)

**spacecraft.** Active and passive satellites and space probes. (WA)

**space qualified.** Products designed, manufactured, and tested to meet the special electrical, mechanical, or environmental requirements for use in the launch and deployment of satellites or high-altitude flight systems operating at altitudes of 100 km or higher. (WA)

**spatial light modulators.** Optical devices that dynamically modulate the spatial distribution of the amplitude or phase of an incident light waveform across an aperture in either a transmissive or reflective mode of operation under the control of an electronic or optical signal. “Spatial light modulators” are one type of non-linear adaptive optics.

**specific impulse (Is).** The total impulse per unit weight of propellant.

**specific modulus.** Young's modulus in pascals, equivalent to  $\text{N/m}^2$  divided by specific weight in  $\text{N/m}^3$  measured at temperature of  $296 \pm 2 \text{ K}$  ( $23 \pm 2 \text{ }^\circ\text{C}$ ) and a relative humidity of  $50 \pm 5$  percent.

**specific tensile strength.** Ultimate tensile strength in pascals, equivalent to  $\text{N/m}^2$  divided by specific weight in  $\text{N/m}^3$  measured at a temperature of  $296 \pm 2 \text{ K}$  and a relative humidity of  $50 \pm 5$  percent.

**spherical error probable or sphere of equal probability (SEP).** A measure of accuracy at a specific range, expressed in terms of the radius of a sphere, centered on the target, in which 50 percent of the payloads impact.

**splat quenching.** A process to "solidify rapidly" a molten metal stream impinging upon a chilled block, forming a flake-like product. (WA)

**spread spectrum.** The technique whereby energy in a relatively narrow-band communication channel is spread over a much wider energy spectrum. (WA)

**spread spectrum (radar).** See **radar spread spectrum**.

**sputter deposition.** An overlay coating process based on a momentum transfer phenomenon, wherein positive ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on an appropriately positioned substrate. (WA)

**sputtering.** A vacuum deposition method in which the coating material is removed from the surface of the cathode by ion bombardment and deposition upon a substrate. The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on the substrate. N.B. Triode, magnetron, or radio-frequency sputtering to increase adhesion of coating and rate of deposition are ordinary modifications of the process.

**stability.** Standard deviation (1 sigma) of the variation of a particular parameter from its calibrated value measured under stable temperature conditions. This can be expressed as a function of time. (WA)

**stabilizers.** Substances used in explosive formulations to improve their shelf life.

**stacker cranes.** Cartesian coordinate manipulator systems manufactured as an integral part of a vertical array of storage bins and designed to access the contents of those bins for storage or retrieval.

**steganography.** That branch of information privacy that attempts to obscure the existence of data through such devices as invisible inks, secret compartments, and use

of subliminal channels. (*Handbook of Applied Cryptography*)

**stored program control.** A control using instructions stored in an electronic storage which a processor can execute to direct the performance of predetermined functions. (WA)

**strong mechanical bond (*rocket propulsion*).** In solid rocket motors, any adhesive connection between the rocket propellant and the motor casing with a tensile strength equal to or greater than the tensile strength of the propellant.

**substrate.** A sheet of base material with or without an interconnection pattern and on which or within which "discrete components" or integrated circuits or both can be located. (WA)

**substrate blanks.** Monolithic compounds with dimensions suitable for the production of optical elements such as mirrors or optical windows. (WA)

**sufficient technology.** (1) The level of technology required for a proliferant to produce entry-level WMD, delivery systems, or other hardware or software useful in WMD development, integration, or use. (2) Technology required for a proliferant to barely enable the production of the selected WMD or means of delivery (MOD).

**superalloys.** Nickel-, cobalt-, or iron-base alloys having strengths superior to any alloys in the AISI 300 series at temperatures of  $922 \text{ K}$  ( $649 \text{ }^\circ\text{C}$ ) under severe environmental and operating conditions. (WA)

**superconducting.** A material or an electrical device made with a material that exhibits superconductivity at the designed operating temperature.

**superconductive.** Materials (i.e., metals, alloys, or compounds) which can lose all electrical resistance (i.e., which can attain infinite electrical conductivity and carry very large electrical currents without joule heating). (WA)

**superconductivity.** The absence of resistance to the flow of electrical current below a certain temperature in a number of metallic and ceramic substances that allows the passage of electrical current to occur without joule heating.

**super high power laser (SHPL).** A "laser" capable of delivering (the total or any portion of) the output energy exceeding  $1 \text{ kJ}$  within  $50 \text{ ms}$  or having an average or CW power exceeding  $20 \text{ kW}$ . (WA)

**superplastic forming.** The forming of a final product, making use of material characteristics that exhibit extreme tensile deformation prior to failure.

**sustained operations (SUSOPS).** The maintenance of vigilance and operational skills for a 36- to 72-hour period.

**sustainer.** A propulsion system that travels with, and does not separate from, the missile. Usually applied to a rocket motor or rocket engine when used as the principal propulsion system—as distinguished from an auxiliary system, such as the JATO unit.

**synchronous digital hierarchy (SDH).** A digital hierarchy providing a means to manage, multiplex, and access various forms of digital traffic using a synchronous transmission format on different types of media. The format is based on the synchronous transport module (STM) which is defined by CCITT Recommendation G.703, G.708, G.709, and others yet to be published. The first level rate of “SDH” is 155.52 Mbit/s.

**synchronous optical network (SONET).** A network providing a means to manage, multiplex and access various forms of digital traffic using a synchronous transmission format on fiber optics. The format is the North American version of “SDH” and also uses the “STM.” However, it uses the synchronous transport signal (STS) as the basic transport module, with a first-level rate of 51.81 Mbit/s. The SONET standards are being integrated into those of “SDH.”

**syntax.** (1) The relationship among characters or groups of characters, independent of their meanings or the manner of their interpretation and use. (ISO) (2) The structure of expressions in a language. (3) The rules governing the structure of a language. (4) The relationships among symbols. (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM 1981)

**system.** A combination of end items, components, parts, accessories, attachments, firmware, or software, specifically designed, modified, or adapted to operate together to perform a specialized military function. (ITAR Sec 121.8.)

**systems tracks.** Processed, correlated (fusion of radar target data to flight plan position), and updated aircraft flight position report available to the Air Traffic Control center controllers. (WA)

**systolic array computer.** A computer where the flow and modification of the data are dynamically controllable at the logic gate level by the user. (WA)

**tabun.** A nerve agent member of the organophosphate group which inhibits acetylcholinesterase. It is used as a chemical warfare agent and is the least toxic of the nerve agents, but can cause death rapidly.

**tactical decision-making under stress (TADMUS).** A tri-Service program to reduce and manage errors occurring in crisis situations.

**tactical propulsion.** Any type of on-board propulsion for the delivery of ordnance. Includes solid- and gel-rocket motors and air-breathing propulsion for hypervelocity missiles.

**tear gases.** Gases which produce temporarily irritating or disabling effects which disappear within minutes of removal from exposure. (WA)

**technical assistance.** May take forms such as instruction, skills, training, working knowledge, consulting services. Note: “technical assistance” may involve transfer of “technical data.” (EAR Part 772)

**technical data.**

(1) May take forms such as blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals, and instructions written or recorded on other media or devices such as disk, tape, and read-only memories. (EAR Part 772).

(2) Technical data is defined as:

- (a) Information, other than software [described in (d) below], which is required for the design, development, production, manufacture, assembly, operation, repair, testing, maintenance, or modification of defense articles. This includes information in the form of blueprints, drawings, photographs, plans, instructions, and documentation.
- (b) Classified information relating to defense articles and defense services.
- (c) Information covered by an invention secrecy order.
- (d) Software directly related to defense articles.
- (e) This definition does not include information concerning general scientific, mathematical, or engineering principles commonly taught in schools, colleges, and universities or information in the public domain. It also does not include basic marketing information on function or purpose or general system descriptions of defense articles. (ITAR, Sec. 120.10.)

**technologies for weapons of mass destruction.** Technologies required for development, integration, or employment of biological, chemical, or nuclear weapons and their means of delivery.

**technology.** Specific information and know-how necessary for the development, production, or use of a product. This includes engineering and integration for

systems (groups of interacting elements acting as a complex whole) as well as individual hardware and software elements necessary to achieve that purpose.

**telecommunications.** Any process that enables one or more users to pass to one or more other users information of any nature delivered in any usable form by wire, radio, visual, or other electrical, electromagnetic, or optical means. The word is derived from the Greek *tele*, “far off,” and the Latin *communicare*, “to share.” See also **communications**.

**tenacity.** The term used in yarn manufacture and textile engineering to denote the strength of yarn or of a filament of a given size. Numerically, it is the grams of breaking force per denier unit of yarn or filament size.

**terminal guidance, terminal homing.** A procedure taken at the end of a vehicle or weapon’s trajectory, generally in response to direction from on-board sensing devices, to produce an end-game geometry such that weapon lethality is maximized.

**terminal interface equipment.** Equipment at which information enters or leaves the telecommunication system, e.g., telephone, data device, computer, and facsimile device. (WA)

**terrain contour matching (TERCOM).** A guidance and navigation system which measures the topography below a flight vehicle with radar or other electromagnetic energy and compares the results to onboard maps, to determine location.

**tesla.** The unit of measure for magnetic induction which is equal to 1 weber per square meter.

**tetrahedral.** A polyhedral angle with four sides.

**thermal battery.** A subclass of primary batteries used in short-term, high-power, single-shot operation. Since an extremely long shelf life is typically required, thermal batteries store the electrolyte as a solid until power is required, thus minimizing self-discharge. Pyrotechnics then generate sufficient heat, transforming the solid into a molten electrolyte which activates the battery.

**thermal evaporation–physical vapor deposition (TE–PVD).** An overlay coating process conducted in a vacuum with a pressure usually less than 0.1 Pa wherein a source of thermal energy is used to vaporize the coating material. This process results in the condensation/deposition of the evaporated species onto appropriately positioned substrates. The addition of gases to the vacuum chamber during the coating process to synthesize compound coatings is an ordinary modification of the process. The use of ion or electron beams, or plasma, to activate or assist the coating’s deposition is also a common modification in this technique. The

use of monitors to provide in-process measurement of optical characteristics and thickness of coatings can be a feature of these processes.

Specific TE–PVD processes are as follows:

- Electron-beam PVD uses an electron beam to heat and evaporate the material which forms the coating;
- Ion-assisted resistive heating PVD employs electrically resistive heating sources capable of producing a controlled and uniform vapor flux of coating species;
- “Laser” evaporation uses either pulsed- or continuous-wave “laser” beams to heat the material, causing it to vaporize and deposit in the form of a coating;
- Cathodic-arc deposition employs a consumable cathode of the material which forms the coating and has an arc discharge established on the surface by a momentary contact of a ground trigger. Controlled motion of arcing erodes the cathode surface, creating a highly ionized plasma. The anode can be either a cone attached to the periphery of the cathode through an insulator or the chamber. Substrate biasing is used for non-line-of-sight deposition.

**thermal management.** The product of product design, material selection, and fabrication that ensures the temperatures within a system are controlled within specific limits under all expected operating conditions.

**thermite.** Incendiaries that are a mixture of powdered iron oxide, powdered aluminum, and other materials.

**three-dimensional vector rate.** The number of vectors generated per second which have 10-pixel poly-line vectors, clip tested, randomly oriented, with either integer or floating point X-Y-Z coordinate values (whichever produces the maximum rate). (WA)

**thrust.** The force that propels a body or the rate of change of momentum of a burning propellant.

**thyristor.** A three-junction, four-layer (*pnpn*) semiconductor used primarily where high voltage and power are required but switching speed is not.

**tilting spindle.** A tool-holding spindle which alters, during the machining process, the angular position of its center line with respect to any other axis. (WA)

**time constant.** The time taken from the application of a line stimulus for the current increment to reach a value of 1–1/e times the final value (i.e., 63 percent of the final value). (WA)

**time fuze.** A fuze which contains a graduated time element to regulate the time interval after which the fuze will function. (DoD, NATO) See also **fuze**.

**tissue engineering.** The production of large volumes of human or animal cells that have desired genetic properties and can be implanted into persons following injury or in preparation for anticipated injury.

**total digital transfer rate.** The number of bits, including line coding, overhead, and so forth, per unit time passing between corresponding equipment in a digital transmission system. (WA) See also **digitizing rate**.

**total impulse ( $I_t$ ).** The thrust force  $F$  (which can vary with time) integrated over the burning time,  $t$ .

**toxic chemical.** Any chemical which through its chemical action on life processes can cause death, temporary incapacitation, or permanent harm to humans or animals in military feasible quantities.

**toxin.** Poisonous substances produced by living organisms.

**transducer.** A device for converting energy from one form to another. (*Vocabulary for Data Processing, Telecommunications, and Office Systems*, Seventh Edition, IBM 1981)

**tunable (lasers).** The ability of a "laser" to produce a continuous output at all wavelengths over a range of several laser transitions. A line-selectable laser produces discrete wavelengths within one laser transition and is not considered "tunable." (WA)

**turnkey plant.** Consists of all the hardware, software, technical data, and technical assistance necessary for the installation of a complete operating facility for the production of the commodity, a chemical substance, at defined production rates and to specified product qualities. Hardware consists of all the equipment, components, control valves, instruments, reaction vessels, feed lines, and explosion-proof barriers necessary for the conduct of the unit operations of the overall production process, whether the items are assembled or disassembled for transportation. The plant may be designed for installation at a prepared site that includes locally constructed and installed explosion-proof barricades.

**uranium enriched in the isotopes 235 or 233.** Uranium containing the isotopes 235, 233, or both in the amount such that the abundance ratio of the sum of these isotopes to the isotope 238 is more than the ratio of the isotope 235 to the isotope 238 occurring in nature (isotopic ratio: 0.72 percent).

**use.** Operation, installation (including on-site installation), maintenance (checking), repair, overhaul, and refurbishing. (WA)

**user-accessible programmability.** The facility allowing a user to insert, modify, or replace programs by means other than (a) a physical change in wiring or interconnections *or* (b) the setting of function controls including entry of parameters.

**V50.** The velocity at which 50 percent of the projectiles of a specific type will penetrate a given armor design.

**vaccines.** Materials that when appropriately administered into immune, competent, responsive persons and animals will enable the human and animal recipient to become resistant to infection. The body produces antibodies that react with the infectious agent. Multi-component and multivalent vaccines specifically protect populations against two or more pathogens.

**vacuum atomization.** A process to reduce a molten stream of metal to droplets of a diameter of 500  $\mu\text{m}$  or less by the rapid evolution of a dissolved gas upon exposure to a vacuum. (WA)

**variable geometry airfoils.** Trailing edge flaps or tabs or leading edge slats or pivoted nose droop, the position of which can be controlled in flight. (WA)

**vector rate.** See **three-dimensional vector rate**.

**vehicle management system (VMS).** A vehicle-control system characterized by a high degree of physical and functional integration of manual and automatic flight controls, propulsion controls, and airframe utility subsystem controls.

**vesicant.** Toxic chemicals that have a blistering effect on the skin.

**virus.** Any of a large group of submicroscopic agents infecting plants, animals, and bacteria and unable to reproduce outside the tissues of the host. A fully formed virus consists of nucleic acid (DNA or RNA) surrounded by a protein or protein and lipid coat.

**V-series nerve agents** A class of chemical agents developed in the 1950's that act by inhibiting a key nervous system enzyme. They are generally persistent and have moderate to high toxicity. Examples are VE, VG, VM, VS, and VX. See also **nerve agent**.

**Wassenaar Arrangement.** A multilateral arrangement on export control for conventional weapons and dual-use goods and technologies. It was designed to promote transparency and responsibility in transfers of conventional arms and dual-use goods and technologies, thus preventing destabilizing accumulations that could lead to threats to international and regional peace and security.

**warhead.** That portion of a rocket or guided missile that contains the load that the vehicle is to deliver. It may be empty or contain high explosives, chemicals, instru-

ments, or inert materials. It may also include a booster, fuze(s), adaption kits, and/or burster(s).

**weapons of mass destruction.** Weapons that are capable of a high order of destruction and/or of being used in such a manner as to destroy large numbers of people. Weapons of mass destruction can be high explosives or nuclear, biological, chemical, and radiological weapons, but exclude the means of transporting or propelling the weapon where such means is a separable and divisible part of the weapon. Also called WMD. (JP 1-02)

**Weapons of Mass Destruction (WMD) Technologies.** Technologies used in weapons of mass destruction and their means of delivery.

**Weapons Systems Technologies (WST).** Technologies critical to the development and production of superior weapons.

**web.** In a grain of propellant, the minimum thickness of the grain between any two adjacent surfaces is called the web or the web thickness. In a cord the diameter is the web. In a single perforated grain there is one web, but in a multiperforated grain there is an inner web and an outer web. The mean of these values is known as the average web. In designs of solid, or single-perforated, grains, the propellant is entirely consumed when the web is burned through. In multiperforated grains this is not true; slivers are formed at this stage, which then burn to completion.

**weber.** The unit of measure for magnetic flux whose decrease to zero when linked with a single turn induces in the turn a voltage time integral is 1 V-sec.

**yield.** In chemical reactions, the quality of pure product divided by the starting material.